ANNEXES TO THE NATIONAL INVENTORY REPORT

2009

TABLE OF CONTENTS

Annex 1 Key Categories

A1.1. Description of methodology used for identifying key sources

The IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC, 2000) recommend as good practice the identification of key source categories of emissions. As a result of the adoption (Decision 13/CP.9) of the LULUCF Good Practice Guidance (IPCC, 2003) the concept of key sources has been expanded in order to cover LULUCF emissions by sources and removals by sinks. Therefore the term key category is used in order to include both sources and sinks.

Generally, inventory uncertainty is lower when emissions are estimated using the available most rigorous methods, but due to finite resources this may not be feasible for every category. Therefore it is good practice to identify those categories (key categories) that have the greatest contribution to overall inventory uncertainty in order to make the most efficient use of available resources. In that context, a "key category" is one that is prioritised within the national inventory system because its estimate has a significant influence on a country's total inventory of direct greenhouse gases in terms of the absolute level of emissions (level assessment) or/and to the trend of emissions (trend assessment).

This annex describes the key category analysis conducted for the 2009 Hungarian inventory. Good practice first requires that inventories be disaggregated into categories from which key sources and sinks may be identified. Adopting the detailed categorization of sources/sinks that is recommended by the European Union (see *Table A1-1*), analysis of key categories was conducted according to the Tier1 methodology described in the IPCC Good Practice Guidance. This approach identifies key categories from two perspectives. The first analyzes the emission contribution that each category makes to the national total (with LULUCF). The second perspective analyzes the trend of emission contributions from each category to identify where the greatest absolute changes (either increases or reductions) have taken place over a given time (with LULUCF categories). The percent contributions to both levels and trends in emissions are calculated and sorted from greatest to least. A cumulative total is calculated for both approaches. IPCC has determined that a cumulative contribution threshold of 95% for both level and trend assessments is a reasonable approximation of 90% uncertainty for the Tier 1 method of determining key categories (IPCC, 2000). The 95% cumulative contribution threshold has been used in this analysis to define an upper boundary for key category identification. Therefore, when source and/or sink contributions are sorted in decreasing order of importance, those that contribute to 95% of the cumulative total are considered quantitatively to be key. Results for these analysis are shown in *Table A1-3* and *Table A1-4*.

Since uncertainty estimates are not available for the LULUCF sector Tier 2 method was applied to find key categories only for source categories (without LULUCF) and for more aggregated categories, which were used in the previos submissions (see *Table A1-2*). The required uncertainty values for source categories are listed in *Table A7-1*. The calculation was performed using the spreadsheet 6.1 described in the IPCC Good Practice Guidance (IPCC, 2000). The percent contributions to both levels and trends in emissions are calculated and sorted from greatest to least. A cumulative total is calculated for both approaches and the key source categories are identified by accounting for those that add up to 90 % of the cumulative total. Results from Tier 2 approach can be seen in *Table A1-5*, *Table A1-6.*

A1.2. Reference to the key source tables in the CRF

Table A1-1. *IPCC source/sink categories for Tier 1 key source analysis*

CRF code	sub-categories	IPCC Source/Sink Categories	Direct Greenhouse Gas
1A1a	li,so,ga,ot	Energy - Stationary Combustion - Public electricity and heat production	CO_2
1A1a	li,so,ga,bi,ot	Energy - Stationary Combustion - Public electricity and heat production	CH_4
1A1a	li,so,ga,bi,ot	Energy - Stationary Combustion - Public electricity and heat production	N_2O
1A1b	li,ga,ot	Energy - Stationary Combustion - Petroleum refining	CO_2
1A1b	li,ga,bi,ot	Energy - Stationary Combustion - Petroleum refining	CH_4
1A1b	li,ga,bi,ot	Energy - Stationary Combustion - Petroleum refining	N_2O
1A1c	li,so,ga	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	CO_2
1A1c	li,so,ga,bi	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	CH_4
1A1c	li,so,ga,bi	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	N_2O
1A2a	li,so,ga	Energy - Stationary Combustion - Iron and steel	CO_2
1A2a	li,so,ga,bi	Energy - Stationary Combustion - Iron and steel	CH_4
1A2a	li,so,ga,bi	Energy - Stationary Combustion - Iron and steel	N_2O
1A2b	li,so,ga	Energy - Stationary Combustion - Non-ferrous metals	CO_2
1A2b	li,so,ga,bi	Energy - Stationary Combustion - Non-ferrous metals	CH_4
1A2b	li,so,ga,bi	Energy - Stationary Combustion - Non-ferrous metals	N_2O
1A2c	li,so,ga	Energy - Stationary Combustion - Chemicals	CO_2
1A2c	li,so,ga,bi	Energy - Stationary Combustion - Chemicals	CH_4
1A2c	li,so,ga,bi	Energy - Stationary Combustion - Chemicals	N_2O
1A2d	li,so,ga	Energy - Stationary Combustion - Pulp, paper and print	CO_2
1A2d	li,so,ga,bi	Energy - Stationary Combustion - Pulp, paper and print	CH_4
1A2d	li,so,ga,bi	Energy - Stationary Combustion - Pulp, paper and print	N_2O
1A2e	li,so,ga	Energy - Stationary Combustion - Food processing, beverages and tobacco	CO_2
1A2e	li,so,ga,bi	Energy - Stationary Combustion - Food processing, beverages and tobacco	CH_4
1A2e	li,so,ga,bi	Energy - Stationary Combustion - Food processing, beverages and tobacco	N_2O
1A2f	li,so,ga,ot	Energy - Stationary Combustion - Other	CO_2
1A2f	li,so,ga,ot,bi	Energy - Stationary Combustion - Other	CH_4
1A2f	li,so,ga,ot,bi	Energy - Stationary Combustion - Other	N_2O
1A3a	lg,lk	Energy - Mobile combustion - Civil aviation	CO_2
1A3a	lg,lk	Energy - Mobile combustion - Civil aviation	CH_4
1A3a	lg,lk	Energy - Mobile combustion - Civil aviation	N_2O
1A3b	lg,ld,ll,gn	Energy - Mobile combustion - Road transportation	CO_2
1A3b	lg,ld,ll,gn,bi	Energy - Mobile combustion - Road transportation	CH_4
1A3b	lg,ld,ll,gn,bi	Energy - Mobile combustion - Road transportation	N_2O
1A3c	li,so,ga	Energy - Mobile combustion - Railways	CO_2
1A3c	li,so,ga	Energy - Mobile combustion - Railways	CH_4

Table A1-1. *IPCC source/sink categories for Tier 1 key source analysis*

CRF code	sub-categories	IPCC Source/Sink Categories	Direct Greenhouse Gas
1A3c	li,so,ga	Energy - Mobile combustion - Railways	N_2O
1A3d	lr,ld,lg,lu,sc	Energy - Mobile combustion - Navigation	CO_2
1A3d	lr,ld,lg,lu,sc	Energy - Mobile combustion - Navigation	CH_4
1A3d	lr,ld,lg,lu,sc	Energy - Mobile combustion - Navigation	N_2O
1A4a	li,so,ga	Energy - Stationary Combustion - Commercial	CO_2
1A4a	li,so,ga,bi	Energy - Stationary Combustion - Commercial	CH_4
1A4a	li,so,ga,bi	Energy - Stationary Combustion - Commercial	N_2O
1A4b	li,so,ga	Energy - Stationary Combustion - Residential	CO_2
1A4b	li,so,ga,bi	Energy - Stationary Combustion - Residential	CH_4
1A4b	li,so,ga,bi	Energy - Stationary Combustion - Residential	N_2O
1A4c	li,so,ga	Energy - Stationary Combustion - Agriculture	CO_2
1A4c	li,so,ga,bi	Energy - Stationary Combustion - Agriculture	CH_4
1A4c	li,so,ga,bi	Energy - Stationary Combustion - Agriculture	N_2O
1B1a		Energy - Fugitive Emissions from Fuels - Solid Fuels	CO_2
1B1a		Energy - Fugitive Emissions from Fuels - Solid Fuels	CH_4
1B1a		Energy - Fugitive Emissions from Fuels - Solid Fuels	N_2O
1B2a		Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CO_2
1B2b		Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CO_2
1B2c		Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CO_2
1B2d		Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CO_2
1B2a		Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4
1B2b		Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4
1B2c		Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4
1B2d		Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4
1B2a		Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	N_2O
1B2b		Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	N_2O
1B2c		Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	N_2O
1B2d		Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	N_2O
2A1		Industrial Processes - Mineral Products - Cement production	CO_2
2A2		Industrial Processes - Mineral Products - Lime production	CO_2
2A3		Industrial Processes - Mineral Products - Limestone and dolomit use	CO_2
2A5		Industrial Processes - Mineral Products - Asphalt roofing	CO_2
2A6		Industrial Processes - Mineral Products - Road paving with asphalt	CO_2
2A7		Industrial Processes - Mineral Products - Other	CO_2
2A7		Industrial Processes - Mineral Products - Other	CH_4
2A7		Industrial Processes - Mineral Products - Other	N_2O
2B1		Industrial Processes - Chemical Industry - Ammonia production	CO_2
2B1		Industrial Processes - Chemical Industry - Ammonia production	CH_4

Table A1-1. *IPCC source/sink categories for Tier 1 key source analysis*

CRF code	sub-categories	IPCC Source/Sink Categories	Direct Greenhouse Gas
2B1		Industrial Processes - Chemical Industry - Ammonia production	N_2O
2B2		Industrial Processes - Chemical Industry - Nitric acid production	CO_2
2B2		Industrial Processes - Chemical Industry - Nitric acid production	N_2O
2B5		Industrial Processes - Chemical Industry - Other	CO_2
2B5		Industrial Processes - Chemical Industry - Other	CH_4
2B5		Industrial Processes - Chemical Industry - Other	N_2O
2C1		Industrial Processes - Metal Production - Iron and steel production	CO_2
2C1		Industrial Processes - Metal Production - Iron and steel production	CH_4
2C2		Industrial Processes - Metal Production - Ferroalloys production	CO_2
2C2		Industrial Processes - Metal Production - Ferroalloys production	CH_4
2C3		Industrial Processes - Metal Production - Aluminium production	CO_2
2C3		Industrial Processes - Metal Production - Aluminium production	CH_4
2C4		Industrial Processes - Metal Production - Aluminium production	PFCs
2D		Industrial Processes - Other Production	CO_2
2E		Industrial Processes - Production of Halocarbons and SF6	HFCs
2E		Industrial Processes - Production of Halocarbons and SF6	PFCs
2E		Industrial Processes - Production of Halocarbons and SF6	SF_6
2Fa1		Industrial Processes - Consumption of Halocarbons and SF6 - Refrigeration and iar conditioning equipment	HFCs
2Fa1		Industrial Processes - Consumption of Halocarbons and SF6 - Refrigeration and iar conditioning equipment	PFCs
2Fa1		Industrial Processes - Consumption of Halocarbons and SF6 - Refrigeration and iar conditioning equipment	SF_6
2Fa2		Industrial Processes - Consumption of Halocarbons and SF6 - Foam blowing	HFCs
2Fa2		Industrial Processes - Consumption of Halocarbons and SF6 - Foam blowing	PFCs
2Fa2		Industrial Processes - Consumption of Halocarbons and SF6 - Foam blowing	SF_6
2Fa3		Industrial Processes - Consumption of Halocarbons and SF6 - Fire extinguishers	HFCs
2Fa3		Industrial Processes - Consumption of Halocarbons and SF6 - Fire extinguishers	PFCs
2Fa3		Industrial Processes - Consumption of Halocarbons and SF6 - Fire extinguishers	SF_6
2Fa4		Industrial Processes - Consumption of Halocarbons and SF6 - Aerosols	HFCs
2Fa4		Industrial Processes - Consumption of Halocarbons and SF6 - Aerosols	PFCs
2Fa4		Industrial Processes - Consumption of Halocarbons and SF6 - Aerosols	SF_6
2Fa8		Industrial Processes - Consumption of Halocarbons and SF6 - Electrical equipment	HFCs
2Fa8		Industrial Processes - Consumption of Halocarbons and SF6 - Electrical equipment	PFCs
2Fa8		Industrial Processes - Consumption of Halocarbons and SF6 - Electrical equipment	SF_6
2Fa9		Industrial Processes - Consumption of Halocarbons and SF6 - Other	HFCs
2Fa9		Industrial Processes - Consumption of Halocarbons and SF6 - Other	PFCs
2Fa9		Industrial Processes - Consumption of Halocarbons and SF6 - Other	SF_6

Table A1-1. *IPCC source/sink categories for Tier 1 key source analysis*

CRF code	sub-categories	IPCC Source/Sink Categories	Direct Greenhouse Gas
2G1		Industrial Processes - Feedstocks	CO_2
2G2		Industrial Processes - Non-energy use	CO_2
3a		Solvent and Other Product Use - Paint Application	CO_2
3b		Solvent and Other Product Use - Degreasing and Dry Cleaning	CO_2
3d		Solvent and Other Product Use - Other	N_2O
4A1	ca	Agriculture - Enteric Fermentation	CH_4
4A2	bu	Agriculture - Enteric Fermentation	CH_4
4A3	sh	Agriculture - Enteric Fermentation	CH_4
4A4	ot	Agriculture - Enteric Fermentation	CH_4
4B1	ca	Agriculture - Manure Management	CH_4
4B2	bu	Agriculture - Manure Management	CH_4
4B3	sh	Agriculture - Manure Management	CH_4
4B4	ot	Agriculture - Manure Management	CH_4
4B8	sw	Agriculture - Manure Management	CH_4
4B12	liq	Agriculture - Manure Management	N_2O
4B13	so	Agriculture - Manure Management	N_2O
4C		Agriculture - Rice Cultivation	CH_4
4D1		Agriculture - Agricultural Soils - Direct soil emissions	CH_4
4D1		Agriculture - Agricultural Soils - Direct soil emissions	N_2O
4D2		Agriculture - Agricultural Soils - Pasture, range and paddock manure	N_2O
4D3		Agriculture - Agricultural Soils - Indirect emissions	CH_4
4D3		Agriculture - Agricultural Soils - Indirect emissions	N_2O
4F		Agriculture - Field Burning of Agricultural Residues	CH_4
4F		Agriculture - Field Burning of Agricultural Residues	N_2O
5A1		Land Use, Land-Use Change and Forestry - Forest Land - remaining	CO_2
5A1		Land Use, Land-Use Change and Forestry - Forest Land - remaining	CH_4
5A1		Land Use, Land-Use Change and Forestry - Forest Land - remaining	N_2O
5A2		Land Use, Land-Use Change and Forestry - Forest Land Land converted to	CO_2
5A2		Land Use, Land-Use Change and Forestry - Forest Land - Land converted to	CH_4
5A2		Land Use, Land-Use Change and Forestry - Forest Land - Land converted to	N_2O
5B1		Land Use, Land-Use Change and Forestry - Cropland - remaining	CO_2
5B1		Land Use, Land-Use Change and Forestry - Cropland - remaining	CH_4
5B1		Land Use, Land-Use Change and Forestry - Cropland - remaining	N_2O
5B2		Land Use, Land-Use Change and Forestry - Cropland - Land converted to	CO_2
5B2		Land Use, Land-Use Change and Forestry - Cropland - Land converted to	CH_4
5B2		Land Use, Land-Use Change and Forestry - Cropland - Land converted to	N_2O
5C1		Land Use, Land-Use Change and Forestry - Grassland - remaining	CO_2

Table A1-1. *IPCC source/sink categories for Tier 1 key source analysis*

CRF code	sub-categories	IPCC Source/Sink Categories	Direct Greenhouse Gas
5C1		Land Use, Land-Use Change and Forestry - Grassland - remaining	CH_4
5C1		Land Use, Land-Use Change and Forestry - Grassland - remaining	N_2O
5C2		Land Use, Land-Use Change and Forestry - Grassland - Land converted to	CO_2
5C2		Land Use, Land-Use Change and Forestry - Grassland - Land converted to	CH_4
5C2		Land Use, Land-Use Change and Forestry - Grassland - Land converted to	N_2O
5E1		Land Use, Land-Use Change and Forestry - Settlements - remaining	CO_2
5E1		Land Use, Land-Use Change and Forestry - Settlements - remaining	CH_4
5E1		Land Use, Land-Use Change and Forestry - Settlements - remaining	N_2O
5E2		Land Use, Land-Use Change and Forestry - Settlements - Land converted to	CO_2
5E2		Land Use, Land-Use Change and Forestry - Settlements - Land converted to	CH_4
5E2		Land Use, Land-Use Change and Forestry - Settlements - Land converted to	N_2O
6A		Waste - Solid Waste Disposal on Land	CH_4
6B1		Waste - Waste-water Handling - Industrial	CH_4
6B2		Waste - Waste-water Handling - Domestic and Commercial	CH_4
6B1		Waste - Waste-water Handling - Industrial	N_2O
6B2		Waste - Waste-water Handling - Domestic and Commercial	N_2O
6C		Waste - Waste Incineration	CO_2
6C		Waste - Waste Incineration	CH_4

Abbrevations in this table:

li – liquid fuels
so – solid fuels/ solid manure management systems
ga – gaseous fuels
ot – other fuels/ other livestock categories
bi – biomass
lr – liquid fuels, residual fuel oil
ld – liquid fuel, diesel oil
lg – liquid fuel, gasoline
liq – liquid manure management systems
lu – liquid fuel, lubricants
sc – solid fuel, coal
lk – liquid fuel, kerosene
ll – liquid fuel, LPG
gn – gaseous fuel, natural gas
ca – cattle
bu –buffalo
sh – sheep
sw – swine

Table A1-2. *IPCC source/sink categories for Tier 2 key source analysis*

CRF code	IPCC Source/Sink Categories	Direct Greenhouse Gas
1. A	Stationary Combustion - Gas	CO_2
1. A	Stationary Combustion - Coal	CO_2
1. A	Stationary Combustion - Oil	CO_2
1. A	Non-CO_2 Emission from Stationary Fuel Combustion	N_2O
1. A	Non-CO_2 Emission from Stationary Fuel Combustion	CH_4
1. A	Stationary Combustion - Other Fuel	CO_2
1. A. 3	Mobile Combustion	N_2O
1. A. 3	Mobile Combustion - Other	CO_2
1. A. 3	Mobile Combustion	CH_4
1. A. 3. B	Mobile Combustion - Road Vehicles	CO_2
1. B. 1	Fugitive Emissions from Coal Mining and Handling	CH_4
1. B. 1	Fugitive Emissions from Coal Mining and Handling	CO_2
1. B. 2	Fugitive Emissions from Oil and Gas Operations (Main Source: Gas Distribution)	CH_4
1. B. 2	Fugitive Emissions from Oil and Gas Operations	CO_2
1. B. 2	Fugitive Emissions from Oil and Gas Operations	N_2O
2.	N_2O Emission from Industry	N_2O
2.	CH_4 Emission from Industry	CH_4
2. A. 1	CO_2 Emissions from Cement Production	CO_2
2. A. 2	CO_2 Emissions from Lime Production	CO_2
2. A. 3	CO_2 Emission from Limestone and Dolomit Use	CO_2
2. A. 7	CO_2 Emission from Other Mineral Products	CO_2
2. B. 1	CO_2 Emissions from Ammonia Processes	CO_2
2. B. 2	CO_2 Emissions from Nitric Acid Production	CO_2
2. C	CO_2 Emissions from Metal Production	CO_2
2. C. 3	PFCs Emissions from Industry	PFCs
2. F	Emissions from HFCs consumption	HFCs
2. F. 7	SF_6 Emissions from Electrical Equipment	SF_6
2. G	Feedstocks and non-energy use of fuels	CO_2
3.	N_2O Emission from Solvent and Other Product Use	N_2O
3.	CO_2 Emission from Solvent and Other Product Use	CO_2
4. A	CH_4 Emissions from Enteric Fermentation in Domestic Livestock	CH_4
4. B	CH_4 Emissions from Manure Management	CH_4
4. B	N_2O Emissions from Manure Management	N_2O
4. C	CH_4 Emission from Rice Cultivation	CH_4
4. D. 1	Direct N_2O Emissions from Agricultural Soils	N_2O
4. D. 2	Pasture, Range and Paddock Manure	N_2O

Table A1-2. *IPCC source/sink categories for Tier 2 key source analysis*

CRF code	IPCC Source/Sink Categories	Direct Greenhouse Gas
4. D. 3	Indirect N_2O Emissions from Nitrogen Used in Agriculture	N_2O
4. F	Field Burning of Agricultural Residues	N_2O
4. F	Field Burning of Agricultural Residues	CH_4
6. A	CH_4 Emissions from Solid Waste Disposal Sites	CH_4
6. B	Emissions from Wastewater Handling	CH_4
6. B	Emissions from Wastewater Handling	N_2O
6. C	Non-biogenic CO_2 from Waste	CO_2
6. C	Emissions from Waste Incineration	CH_4
6. C	Emissions from Waste Incineration	N_2O

A1.3. Results of the key category analysis

Table A1-3. *Key Categories with LULUCF, Tier 1 Level Assessment*

CRF Code + subcat.	IPCC Categories	Direct Greenhouse Gas	Current Year (2009) Emission (Gg)	Emission in absolute value (Gg CO_2-eq.)	Level Assessment	Cumulative Total
1A4bga	Energy - Stationary Combustion - Residential	CO_2	7 826.69	7826.69	0.1095	0.1095
1A3bld	Energy - Mobile combustion - Road transportation	CO_2	7 701.94	7701.94	0.1078	0.2173
1A1aso	Energy - Stationary Combustion - Public electricity and heat production	CO_2	7 548.63	7548.63	0.1056	0.3229
1A1aga	Energy - Stationary Combustion - Public electricity and heat production	CO_2	6 231.19	6231.19	0.0872	0.4101
1A3blg	Energy - Mobile combustion - Road transportation	CO_2	4 216.35	4216.35	0.0590	0.4691
1A4aga	Energy - Stationary Combustion - Commercial/institutional	CO_2	3 599.13	3599.13	0.0504	0.5195
5A1	Land Use, Land-Use Change and Forestry - Forest Land - remaining	CO_2	-3 076.86	3076.86	0.0431	0.5625
6A	Waste - Solid Waste Disposal on Land	CH_4	142.39	2990.24	0.0418	0.6044
4D1	Agriculture - Agricultural Soils - Direct soil emissions	N_2O	9.27	2873.42	0.0402	0.6446
1A2aso	Energy - Stationary Combustion - Iron and steel	CO_2	1 888.04	1888.04	0.0264	0.6710
4D3	Agriculture - Agricultural Soils - Indirect emissions	N_2O	5.73	1775.60	0.0248	0.6958
1B2b	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4	72.09493	1513.99	0.0212	0.7170
4A1ca	Agriculture - Enteric Fermentation	CH_4	59.42	1247.72	0.0175	0.7345
1A2fga	Energy - Stationary Combustion - Other	CO_2	1 014.05	1014.05	0.0142	0.7487
2A1	Industrial Processes - Mineral Products - Cement production	CO_2	972.71	972.71	0.0136	0.7623
4B13so	Agriculture - Manure Management	N_2O	2.88	894.29	0.0125	0.7748
1A1bli	Energy - Stationary Combustion - Petroleum refining	CO_2	864.01	864.01	0.0121	0.7869
2G1	Industrial Processes - Feedstocks	CO_2	854.87	854.87	0.0120	0.7988
2Fa1	Industrial Processes - Consumption of Halocarbons and SF_6 - Refrigeration and iar conditioning equipment	HFCs	776.12	776.12	0.0109	0.8097
4B8sw	Agriculture - Manure Management	CH_4	35.30	741.23	0.0104	0.8201
1A4cli	Energy - Stationary Combustion - Agriculture/Forestry/Fisheries	CO_2	697.07	697.07	0.0098	0.8298

Table A1-3. *Key Categories with LULUCF, Tier 1 Level Assessment*

CRF Code + subcat.	IPCC Categories	Direct Greenhouse Gas	Current Year (2009) Emission (Gg)	Emission in absolute value (Gg CO_2-eq.)	Level Assessment	Cumulative Total
1A1ali	Energy - Stationary Combustion - Public electricity and heat production	CO_2	601.36	601.36	0.0084	0.8382
1A4bso	Energy - Stationary Combustion - Residential	CO_2	572.49	572.49	0.0080	0.8463
1A2cga	Energy - Stationary Combustion - Chemicals	CO_2	533.86	533.86	0.0075	0.8537
1A2ega	Energy - Stationary Combustion - Food processing, beverages and tobacco	CO_2	511.16	511.16	0.0072	0.8609
5B1	Land Use, Land-Use Change and Forestry - Cropland - remaining	CO_2	-493.75	493.75	0.0069	0.8678
1A2fli	Energy - Stationary Combustion - Other	CO_2	464.20	464.20	0.0065	0.8743
1B2d	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4	22.07	463.42	0.0065	0.8808
5C1	Land Use, Land-Use Change and Forestry - Grassland - remaining	CO_2	443.61	443.61	0.0062	0.8870
2B1	Industrial Processes - Chemical Industry - Ammonia production	CO_2	432.63	432.63	0.0061	0.8930
6B2	Waste - Waste-water Handling - Domestic and Commercial	CH_4	19.75	414.66	0.0058	0.8988
1A1bga	Energy - Stationary Combustion - Petroleum refining	CO_2	403.95	403.95	0.0057	0.9045
3d	Solvent and Other Product Use - Other	N_2O	0.94	292.18	0.0041	0.9086
1A4cga	Energy - Stationary Combustion - Agriculture/Forestry/Fisheries	CO_2	290.43	290.43	0.0041	0.9126
1A2aga	Energy - Stationary Combustion - Iron and steel	CO_2	290.20	290.20	0.0041	0.9167
2A3	Industrial Processes - Mineral Products - Limestone and dolomit use	CO_2	271.75	271.75	0.0038	0.9205
1A1aot	Energy - Stationary Combustion - Public electricity and heat production	CO_2	269.78	269.78	0.0038	0.9243
1A3cli	Energy - Mobile combustion - Railways	CO_2	264.71	264.71	0.0037	0.9280
1A2fso	Energy - Stationary Combustion - Other	CO_2	262.86	262.86	0.0037	0.9317
1A3blg	Energy - Mobile combustion - Road transportation	N_2O	0.83	257.34	0.0036	0.9353
5B2	Land Use, Land-Use Change and Forestry - Cropland - converted to	CO_2	233.75	233.75	0.0033	0.9385
4A3sh	Agriculture - Enteric Fermentation	CH_4	10.09	211.81	0.0030	0.9415

Table A1-3. *Key Categories with LULUCF, Tier 1 Level Assessment*

CRF Code + subcat.	IPCC Categories	Direct Greenhouse Gas	Current Year (2009) Emission (Gg)	Emission in absolute value (Gg CO_2-eq.)	Level Assessment	Cumulative Total
1A4bli	Energy - Stationary Combustion - Residential	CO_2	209.21	209.21	0.0029	0.9444
5C2	Land Use, Land-Use Change and Forestry - Grassland - converted to	CO_2	-208.97	208.97	0.0029	0.9473
2A2	Industrial Processes - Mineral Products - Lime production	CO_2	205.98	205.98	0.0029	0.9502

Table A1-4. *Key Categories with LULUCF, Tier 1 Trend Assessment*

CRF Code + subcat.	IPCC Categories	Direct GHG	Base Years (1985-87) Emission (Gg CO_2-eq.)	Current Year (2009) Emission (Gg CO_2-eq.)	Trend Assess-ment	% Contribu-tion to Trend	Cumulative Total
1A4b	Energy - Stationary Combustion - Residential	CO_2	2 737.18	7 826.69	0.1421	0.1129	0.1129
1A3b	Energy - Mobile combustion - Road transportation	CO_2	2 950.93	7 701.94	0.1362	0.1083	0.2212
1A4b	Energy - Stationary Combustion - Residential	CO_2	10 622.06	572.49	0.1354	0.1076	0.3288
2B2	Industrial Processes - Chemical Industry - Nitric acid production	N_2O	4 541.51	14.81	0.0632	0.0502	0.3790
1A4a	Energy - Stationary Combustion - Commercial/institutional	CO_2	1 535.43	3 599.13	0.0615	0.0488	0.4279
1A1a	Energy - Stationary Combustion - Public electricity and heat production	CO_2	6 212.71	6 231.19	0.0567	0.0450	0.4729
1A1a	Energy - Stationary Combustion - Public electricity and heat production	CO_2	4 429.88	601.36	0.0481	0.0382	0.5112
1A3b	Energy - Mobile combustion - Road transportation	CO_2	3 856.51	4 216.35	0.0432	0.0343	0.5455
6A	Waste - Solid Waste Disposal on Land	CH_4	1 917.30	2 990.24	0.0421	0.0335	0.5790
1A4b	Energy - Stationary Combustion - Residential	CO_2	2 831.45	209.21	0.0348	0.0277	0.6066
1A2f	Energy - Stationary Combustion - Other	CO_2	4 101.08	1 014.05	0.0340	0.0270	0.6337
1A1a	Energy - Stationary Combustion - Public electricity and heat production	CO_2	14 582.44	7 548.63	0.0301	0.0239	0.6576
5A1	Land Use, Land-Use Change and Forestry - Forest Land - remaining	CO_2	-2 963.88	-3 076.86	0.0294	0.0234	0.6810
1A2a	Energy - Stationary Combustion - Iron and steel	CO_2	4 908.90	1 888.04	0.0252	0.0200	0.7010
1A4c	Energy - Stationary Combustion - Agriculture/Forestry/Fisheries	CO_2	2 887.15	697.07	0.0243	0.0193	0.7203
1A2f	Energy - Stationary Combustion - Other	CO_2	1 984.61	262.86	0.0217	0.0173	0.7376
1B2b	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4	946.54	1 513.99	0.0217	0.0172	0.7548
1A2a	Energy - Stationary Combustion - Iron and steel	CO_2	1 980.58	290.20	0.0210	0.0167	0.7715
1A4a	Energy - Stationary Combustion - Commercial/institutional	CO_2	1 395.85	53.76	0.0183	0.0145	0.7860
1A4a	Energy - Stationary Combustion - Commercial/institutional	CO_2	1 295.15	12.86	0.0178	0.0142	0.8002
1A2f	Energy - Stationary Combustion - Other	CO_2	1 709.26	464.20	0.0132	0.0105	0.8107
2G1	Industrial Processes - Feedstocks	CO_2	468.07	854.87	0.0132	0.0105	0.8211

Table A1-4. *Key Categories with LULUCF, Tier 1 Trend Assessment*

CRF Code + subcat.	IPCC Categories	Direct GHG	Base Years (1985-87) Emission (Gg CO_2-eq.)	Current Year (2009) Emission (Gg CO_2-eq.)	Trend Assess-ment	% Contribu-tion to Trend	Cumulative Total
4D3	Agriculture - Agricultural Soils - Indirect emissions	N_2O	3 851.08	1 775.60	0.0130	0.0103	0.8314
2B1	Industrial Processes - Chemical Industry - Ammonia production	CO_2	1 616.22	432.63	0.0126	0.0100	0.8415
1B1a	Energy - Fugitive Emissions from Fuels - Solid Fuels	CH_4	923.01	13.80	0.0126	0.0100	0.8515
1A2e	Energy - Stationary Combustion - Food processing, beverages and tobacco	CO_2	916.21	34.77	0.0120	0.0096	0.8610
4B8	Agriculture - Manure Management	CH_4	2 035.74	741.23	0.0114	0.0091	0.8701
4D1	Agriculture - Agricultural Soils - Direct soil emissions	N_2O	5 490.68	2 873.42	0.0106	0.0084	0.8785
5C1	Land Use, Land-Use Change and Forestry - Grassland - remaining	CO_2	7.04	443.61	0.0101	0.0080	0.8866
1A2a	Energy - Stationary Combustion - Iron and steel	CO_2	722.92	5.96	0.0100	0.0079	0.8945
1A4b	Energy - Stationary Combustion - Residential	CH_4	699.38	37.66	0.0089	0.0071	0.9016
4A1	Agriculture - Enteric Fermentation	CH_4	2 664.41	1 247.72	0.0085	0.0068	0.9084
1A1b	Energy - Stationary Combustion - Petroleum refining	CO_2	919.97	864.01	0.0070	0.0056	0.9140
4B13	Agriculture - Manure Management	N_2O	1 860.58	894.29	0.0054	0.0043	0.9183
1A3b	Energy - Mobile combustion - Road transportation	N_2O	42.49	257.34	0.0053	0.0042	0.9225
5B2	Land Use, Land-Use Change and Forestry - Cropland - converted to	CO_2	5.19	233.75	0.0053	0.0042	0.9267
2A7	Industrial Processes - Mineral Products - Other	CO_2	642.13	164.15	0.0052	0.0041	0.9309
1A4c	Energy - Stationary Combustion - Agriculture/Forestry/Fisheries	CO_2	363.55	2.54	0.0050	0.0040	0.9349
1A1a	Energy - Stationary Combustion - Public electricity and heat production	CO_2	97.62	269.78	0.0049	0.0039	0.9387
5C2	Land Use, Land-Use Change and Forestry - Grassland - converted to	CO_2	4.53	-208.97	0.0048	0.0038	0.9425
1B2d	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4	434.74	463.42	0.0046	0.0037	0.9462
3d	Solvent and Other Product Use - Other	N_2O	154.17	292.18	0.0046	0.0036	0.9498
2A2	Industrial Processes - Mineral Products - Lime production	CO_2	645.03	205.98	0.0043	0.0034	0.9532

Table A1-5. *Key Categories (in blue) without LULUCF, Tier 2 Level Assessment*

IPCC Categories	Direct Greenhouse Gas	Base Years (1985-87) Emission (Gg CO_2-eq.)	Current Year (2009) Emission (Gg CO_2-eq.)	Activity Data Uncer-tainty	Emission Factor Uncer-tainty	Level Assess-ment with Uncertainty	Contribution to Total Uncertainty (%)	Cumulative Total (%)
Direct N_2O Emissions from Agricultural Soils	**N_2O**	**5 490.68**	**2 873.42**	**0**	**381.30**	**16.44**	**46.28**	**46.28**
Indirect N_2O Emissions from Nitrogen Used in Agriculture	**N_2O**	**3 851.08**	**1 775.60**	**0**	**148.49644**	**3.96**	**11.14**	**57.42**
Emissions from Wastewater Handling	**N_2O**	**207.70**	**197.91**	**10**	**1000**	**2.97**	**8.36**	**65.78**
Stationary Combustion - Gas	**CO_2**	**19 924.15**	**20 777.81**	**5**	**5**	**2.20**	**6.21**	**71.99**
Fugitive Emissions from Oil and Gas Operations (Main Source: Gas Distribution)	**CH_4**	**1 613.47**	**2 072.85**	**2**	**50.00**	**1.56**	**4.38**	**76.37**
CH_4 Emissions from Solid Waste Disposal Sites	**CH_4**	**1 917.30**	**2 990.24**	**10**	**30**	**1.42**	**3.99**	**80.36**
N_2O Emissions from Manure Management	**N_2O**	**1 899.61**	**908.04**	**0**	**102.10**	**1.39**	**3.92**	**84.28**
Mobile Combustion - Road	**CO_2**	**6 807.45**	**11 992.22**	**5**	**5**	**1.27**	**3.58**	**87.86**
Stationary Combustion - Coal	**CO_2**	**34 208.95**	**10 432.76**	**2**	**5**	**0.84**	**2.37**	**90.24**
Mobile Combustion	**N_2O**	**95.63**	**393.47**	**5**	**100.00**	**0.59**	**1.66**	**91.90**
CH_4 Emissions from Manure Management	**CH_4**	**2 427.14**	**960.68**	**0**	**24.018424**	**0.35**	**0.97**	**92.87**
CH_4 Emissions from Enteric Fermentation in Domestic Livestock	**CH_4**	**3 435.62**	**1 608.93**	**0**	**13.404629**	**0.32**	**0.91**	**93.79**
Emissions from Substitutes for Ozone Depleting Substances	**HFCs**	**NA,NO**	**851.29**	**10**	**20**	**0.29**	**0.80**	**94.59**
Pasture, range and paddock manure	**N_2O**	**336.01**	**171.64**	**0**	**108.89013**	**0.28**	**0.79**	**95.38**
SF6 Emissions from Electrical Equipment	SF_6	81.02	219.66	80	20	0.27	0.77	96.14
Stationary Combustion - Oil	CO_2	16 277.89	3 263.04	2	5	0.26	0.74	96.89
Emissions from Wastewater Handling	CH_4	847.03	475.82	20	30	0.26	0.72	97.61
Fugitive Emissions from Oil and Gas Operations	CO_2	195.68	100.10	100	80.00	0.19	0.54	98.15
Feedstocks and non-energy use of fuels	CO_2	550.97	854.87	5	10	0.14	0.40	98.56
Non-CO_2 Emission from Stationary Fuel Combustion	N_2O	230.62	129.92	3	50	0.10	0.27	98.83

Table A1-5. *Key Categories (in blue) without LULUCF, Tier 2 Level Assessment*

IPCC Categories	Direct Greenhouse Gas	Base Years (1985-87) Emission (Gg CO_2-eq.)	Current Year (2009) Emission (Gg CO_2-eq.)	Activity Data Uncer-tainty	Emission Factor Uncer-tainty	Level Assess-ment with Uncertainty	Contribution to Total Uncertainty (%)	Cumulative Total (%)
CO_2 Emission from Other Mineral Products	CO_2	642.13	164.15	10	30	0.08	0.22	99.05
Stationary Combustion - Other Fuel	CO_2	96.89	410.33	5	10	0.07	0.19	99.24
CO_2 Emissions from Cement Production	CO_2	1 778.28	972.71	2	2	0.04	0.12	99.36
CH_4 Emission from Rice Cultivation	CH_4	50.54	11.39	0	198.24	0.03	0.10	99.46
Mobile Combustion - Other	CO_2	814.20	267.88	5	5	0.03	0.08	99.54
Non-CO_2 Emission from Stationary Fuel Combustion	CH_4	884.57	202.65	3	8	0.03	0.07	99.61
Non-biogenic CO_2 from Waste	CO_2	NA,NO	68.17	10	20	0.02	0.06	99.67
CO_2 Emissions from Ammonia Processes	CO_2	1 616.22	432.63	2	2	0.02	0.05	99.73
Mobile Combustion	CH_4	45.19	22.35	5	50	0.02	0.05	99.77
CO_2 Emissions from Lime Production	CO_2	645.03	205.98	5	2.00	0.02	0.05	99.82
CO_2 Emission from Solvent and Other Product Use	CO_2	130.36	47.91	10	20	0.02	0.05	99.87
CO_2 Emissions from Metal Production	CO_2	641.57	180.44	2	5	0.01	0.04	99.91
N_2O Emission from Solvent and Other Product Use	N_2O	154.17	292.18	2	1	0.01	0.03	99.93
CO_2 Emission from Limestone and Dolomit Use	CO_2	248.68	271.75	2	1	0.01	0.03	99.96
CH_4 Emission from Industry	CH_4	7.84	25.64	1	20	0.01	0.02	99.98
N_2O Emissions from Waste Incineration	N_2O	NA,NO	1.96	5	100	0.00	0.01	99.99
Fugitive Emissions from Coal Mining and Handling	CH_4	923.01	13.80	3	10	0.00	0.01	100.00
CH_4 Emissions from Waste Incineration	CH_4	NA	0.86	10	50	0.00	0.00	100.00
N_2O Emission from Industry	N_2O	4 541.51	14.81	2	1	0.00	0.00	100.00
Fugitive Emissions from Oil and Gas Operations	N_2O	0.60	0.23	2	100	0.00	0.00	100.00
PFCs Emissions	PFCs	268.49	1.72	1	2	0.00	0.00	100.00
CO_2 Emissions from Nitric Acid Production	CO_2	0.08	0.00	3	40	0.00	0.00	100.00

Table A1-5. *Key Categories (in blue) without LULUCF, Tier 2 Level Assessment*

IPCC Categories	Direct Greenhouse Gas	Base Years (1985-87) Emission (Gg CO_2-eq.)	Current Year (2009) Emission (Gg CO_2-eq.)	Activity Data Uncer-tainty	Emission Factor Uncer-tainty	Level Assess-ment with Uncertainty	Contribution to Total Uncertainty (%)	Cumulative Total (%)
Fugitive Emissions from Coal Mining and Handling	CO_2	3.60	IE,NA,NO	3	10	0.00	0.00	100.00
Field Burning of Agricultural Residues	CH_4	45.51	NO	NO	NO	0.00	0.00	100.00
Field Burning of Agricultural Residues	N_2O	13.337	NO	NO	NO	0.00	0.00	100.00

Table A1-6. *Key Categories (in blue) without LULUCF, Tier 2 Trend Assessment*

IPCC Categories	Direct Greenhouse Gas	Base Years (1985-87) Emission (Gg CO_2-eq.)	Current Year (2009) Emission (Gg CO_2-eq.)	Activity Data Uncer-tainty	Emission Factor Uncer-tainty	Trend Assessment with Uncertainty	Contribution to Total Uncertainty (%)	Cumulative Total (%)
Direct N_2O Emissions from Agricultural Soils	**N_2O**	**5 490.68**	**2 873.42**	**0**	**381.3014**	**3.31**	**21.71**	**21.71**
Indirect N_2O Emissions from Nitrogen Used in Agriculture	**N_2O**	**3 851.08**	**1 775.60**	**0**	**148.4964**	**1.82**	**11.92**	**33.63**
Stationary Combustion - Gas	**CO_2**	**19 924.15**	**20 777.81**	**5.00**	**5.00**	**1.65**	**10.85**	**44.48**
Mobile Combustion - Road	**CO_2**	**6 807.45**	**11 992.22**	**5**	**5**	**1.45**	**9.53**	**54.01**
Fugitive Emissions from Oil and Gas Operations (Main Source: Gas Distribution)	**CH_4**	**1 613.47**	**2 072.85**	**2**	**50**	**1.45**	**9.50**	**63.51**
Stationary Combustion - Coal	**CO_2**	**34 208.95**	**10 432.76**	**2**	**5**	**1.32**	**8.68**	**72.18**
Mobile Combustion	**N_2O**	**95.634**	**393.472**	**5**	**100**	**0.87**	**5.68**	**77.87**
Stationary Combustion - Oil	**CO_2**	**16 277.89**	**3 263.04**	**2**	**5**	**0.86**	**5.67**	**83.54**
N_2O Emissions from Manure Management	**N_2O**	**1 899.61**	**908.04**	**0**	**102.0985**	**0.53**	**3.49**	**87.03**
SF_6 Emissions from Electrical Equipment	**SF_6**	**81.02**	**219.66**	**80.00**	**20**	**0.36**	**2.39**	**89.41**
CH_4 Emissions from Manure Management	**CH_4**	**2 427.14**	**960.68**	**0**	**24.01842**	**0.28**	**1.85**	**91.27**
CO_2 Emission from Other Mineral Products	**CO_2**	**642.13**	**164.15**	**10**	**30.00**	**0.17**	**1.12**	**92.39**
Feedstocks and non-energy use of fuels	**CO_2**	**550.97**	**854.87**	**5**	**10**	**0.15**	**1.00**	**93.40**
N_2O Emission from Industry	**N_2O**	**4 541.51**	**14.81**	**2**	**1.00**	**0.15**	**0.99**	**94.39**
Fugitive Emissions from Coal Mining and Handling	**CH_4**	**923.01**	**13.80**	**3**	**10**	**0.14**	**0.92**	**95.31**
CH_4 Emissions from Enteric Fermentation in Domestic Livestock	CH_4	3 435.62	1 608.93	0	13.40463	0.14	0.90	96.22
Stationary Combustion - Other Fuel	CO_2	96.89	410.33	5	10	0.10	0.66	96.88
CH_4 Emission from Rice Cultivation	CH_4	50.54	11.39	0	198.2423	0.09	0.61	97.49
Pasture, range and paddock manure	N_2O	336.01	171.64	0	108.8901	0.07	0.46	97.94

Table A1-6. *Key Categories (in blue) without LULUCF, Tier 2 Trend Assessment*

IPCC Categories	Direct Greenhouse Gas	Base Years (1985-87) Emission (Gg CO_2-eq.)	Current Year (2009) Emission (Gg CO_2-eq.)	Activity Data Uncer-tainty	Emission Factor Uncer-tainty	Trend Assessment with Uncertainty	Contribution to Total Uncertainty (%)	Cumulative Total (%)
Non-CO_2 Emission from Stationary Fuel Combustion	CH_4	884.57	202.65	3	8	0.07	0.45	98.40
Fugitive Emissions from Oil and Gas Operations	CO_2	195.68	100.10	100	80	0.05	0.31	98.71
Mobile Combustion - Other	CO_2	814.20	267.88	5	5	0.04	0.25	98.95
CO_2 Emissions from Ammonia Processes	CO_2	1 616.22	432.63	2	2	0.04	0.24	99.20
CO_2 Emissions from Metal Production	CO_2	641.57	180.44	2	5	0.03	0.18	99.37
CO_2 Emissions from Lime Production	CO_2	645.03	205.98	5	2	0.02	0.16	99.53
CO_2 Emission from Solvent and Other Product Use	CO_2	130.36	47.91	10	20	0.02	0.11	99.64
N_2O Emission from Solvent and Other Product Use	N_2O	154.17	292.18	2	1	0.01	0.08	99.71
CH_4 Emission from Industry	CH_4	7.84	25.64	1	20	0.01	0.07	99.78
PFCs Emissions	PFCs	268.49	1.72	1	2	0.01	0.06	99.84
CO_2 Emission from Limestone and Dolomit Use	CO_2	248.68	271.75	2	1	0.01	0.05	99.89
Non-CO_2 Emission from Stationary Fuel Combustion	N_2O	230.62	129.92	3	50	0.01	0.04	99.93
Mobile Combustion	CH_4	45.19	22.35	5	50	0.01	0.03	99.97
CO_2 Emissions from Cement Production	CO_2	1 778.28	972.71	2	2	0.00	0.03	100.00
Fugitive Emissions from Oil and Gas Operations	N_2O	0.60	0.23	2	100.00	0.00	0.00	100.00
CO_2 Emissions from Nitric Acid Production	CO_2	0.08	0.00	3	40.00	0.00	0.00	100.00
Fugitive Emissions from Coal Mining and Handling	CO_2	3.60	IE,NA,NO	3	10	0.00	0.00	100.00
Emissions from Substitutes for Ozone Depleting Substances	HFCs	NA,NO	851.29	10	20	0.00	0.00	100.00
Field Burning of Agricultural Residues	CH_4	45.51	NO	NO	NO	0.00	0.00	100.00
Field Burning of Agricultural Residues	N_2O	13.34	NO	NO	NO	0.00	0.00	100.00
CH_4 Emissions from Solid Waste Disposal Sites	CH_4	1 917.30	2 990.24	10	30.00	0.00	0.00	100.00
Emissions from Wastewater Handling	CH_4	847.03	475.82	20	30		0.00	100.00

Table A1-6. *Key Categories (in blue) without LULUCF, Tier 2 Trend Assessment*

IPCC Categories	Direct Greenhouse Gas	Base Years (1985-87) Emission (Gg CO_2-eq.)	Current Year (2009) Emission (Gg CO_2-eq.)	Activity Data Uncer-tainty	Emission Factor Uncer-tainty	Trend Assessment with Uncertainty	Contribution to Total Uncertainty (%)	Cumulative Total (%)
Emissions from Wastewater Handling	N_2O	207.70	197.91	10	1000.00		0.00	100.00
Non-biogenic CO2 from Waste	CO_2	NA,NO	68.17	10	20	0.00	0.00	100.00
CH_4 Emissions from Waste Incineration	CH_4	NA	0.86	10	50	0.00	0.00	100.00
N_2O Emissions from Waste Incineration	N_2O	NA,NO	1.96	5	100	0.00	0.00	100.00

A1.4. Summary assessment

Table A1-7. *Key category analysis summary – with LULUCF*

SOURCE CATEGORY ANALYSIS SUMMARY – WITH LULUCF				
Quantitative Method Used: ☒ **Tier 1** ☐ **Tier 2**				
A	**B**	**C**	**D**	**E**
IPCC Source Categories	**Direct Greenhouse Gas**	**Key Source Category Flag (Yes or No)**	**If C Yes. Criteria for Identification**	**Comments**
1. ENERGY				
Stationary Combustion Public electricity and heat production (1A1a)	**CO_2**	**Yes**	**L,T**	**L:so,ga,li,ot;T: so,ga,li**
Stationary Combustion Public electricity and heat production (1A1a)	CH_4	No		
Stationary Combustion Public electricity and heat production (1A1a)	N_2O	No		
Stationary Combustion Petroleum refining (1A1b)	**CO_2**	**Yes**	**L,T**	**L:li,ga;T:li**
Stationary Combustion Petroleum refining (1A1b)	CH_4	No		
Stationary Combustion Petroleum refining (1A1b)	N_2O	No		
Stationary Combustion Manuf. of solid fuels and other energy industries (1A1c)	CO_2	No		
Stationary Combustion Manuf. of solid fuels and other energy industries (1A1c)	CH_4	No		
Stationary Combustion Manuf. of solid fuels and other energy industries (1A1c)	N_2O	No		
Stationary Combustion Iron and steel (1A2a)	**CO_2**	**Yes**	**L,T**	**L:so,ga;T:so,ga, li**
Stationary Combustion Iron and steel (1A2a)	CH_4	No		
Stationary Combustion Iron and steel (1A2a)	N_2O	No		
Stationary Combustion (1A2b)	CO_2	No		
Stationary Combustion (1A2b)	CH_4	No		
Stationary Combustion (1A2b)	N_2O	No		
Stationary Combustion Chemicals (1A2c)	CO_2	No		
Stationary Combustion Chemicals (1A2c)	CH_4	No		
Stationary Combustion Chemicals (1A2c)	N_2O	No		
Stationary Combustion Pulp, paper and print (1A2d)	CO_2	No		
Stationary Combustion Pulp, paper and print (1A2d)	CH_4	No		
Stationary Combustion Pulp, paper and print (1A2d)	N_2O	No		
Stationary Combustion Food processing, beverages and tobacco (1A2e)	**CO_2**	**Yes**	**L,T**	**L:ga;T:li**
Stationary Combustion Food processing, beverages and tobacco (1A2e)	CH_4	No		
Stationary Combustion Food processing, beverages and tobacco (1A2e)	N_2O	No		
Stationary Combustion Other (1A2f)	**CO_2**	**Yes**	**L,T**	**L:ga,li,so;T:ga,so,li**

Table A1-7. *Key category analysis summary – with LULUCF*

SOURCE CATEGORY ANALYSIS SUMMARY – WITH LULUCF				
Quantitative Method Used: [X] **Tier 1** [ ] **Tier 2**				
A	**B**	**C**	**D**	**E**
IPCC Source Categories	**Direct Greenhouse Gas**	**Key Source Category Flag (Yes or No)**	**If C Yes. Criteria for Identification**	**Comments**
Stationary Combustion Other (1A2f)	CH_4	No		
Stationary Combustion Other (1A2f)	N_2O	No		
Mobile combustion Civil aviation (1A3a)	CO_2	No		
Mobile combustion Civil aviation (1A3a)	CH_4	No		
Mobile combustion Civil aviation (1A3a)	N_2O	No		
Mobile combustion Road transportation (1A3b)	**CO_2**	**Yes**	L,T	L:ld,lg;T: lg,ld
Mobile combustion Road transportation (1A3b)	CH_4	No		
Mobile combustion Road transportation (1A3b)	**N_2O**	**Yes**	**L,T**	**L:lg; T: lg**
Mobile combustion Railways (1A3c)	**CO_2**	**Yes**	**L**	**L:li**
Mobile combustion Railways (1A3c)	CH_4	No		
Mobile combustion Railways (1A3c)	N_2O	No		
Mobile combustion Navigation (1A3d)	CO_2	No		
Mobile combustion Navigation (1A3d)	CH_4	No		
Mobile combustion Navigation (1A3d)	N_2O	No		
Stationary Combustion Commercial/institutional (1A4a)	**CO_2**	**Yes**	**L,T**	**L:ga;T:ga. li, so**
Stationary Combustion Commercial/institutional (1A4a)	CH_4	No		
Stationary Combustion Commercial/institutional (1A4a)	N_2O	No		
Stationary Combustion Residential (1A4b)	**CO_2**	**Yes**	**L,T**	**L:ga,so,li;T:so,li,ga**
Stationary Combustion Residential (1A4b)	**CH_4**	**Yes**	**T**	**T:so**
Stationary Combustion Residential (1A4b)	N_2O	No		
Stationary Combustion Agriculture/Forestry/Fisheries (1A4c)	**CO_2**	**Yes**	**L,T**	**L:li,ga;T:li,so**
Stationary Combustion Agriculture/Forestry/Fisheries (1A4c)	CH_4	No		
Stationary Combustion Agriculture/Forestry/Fisheries (1A4c)	N_2O	No		
Fugitive Emissions from Fuels Solid Fuels (1B1a)	CO_2	No		
Fugitive Emissions from Fuels Solid Fuels (1B1a)	**CH_4**	**Yes**	**T**	

Table A1-7. *Key category analysis summary – with LULUCF*

SOURCE CATEGORY ANALYSIS SUMMARY – WITH LULUCF				
Quantitative Method Used: [X] **Tier 1** [ ] **Tier 2**				
A	**B**	**C**	**D**	**E**
IPCC Source Categories	**Direct Greenhouse Gas**	**Key Source Category Flag (Yes or No)**	**If C Yes. Criteria for Identification**	**Comments**
Fugitive Emissions from Fuels Solid Fuels (1B1a)	N_2O	No		
Fugitive Emissions from Fuels Oil and Natural Gas (1B2a)	CO_2	No		
Fugitive Emissions from Fuels Oil and Natural Gas (1B2b)	CO_2	No		
Fugitive Emissions from Fuels Oil and Natural Gas (1B2c)	CO_2	No		
Fugitive Emissions from Fuels Oil and Natural Gas (1B2d)	CO_2	No		
Fugitive Emissions from Fuels Oil and Natural Gas (1B2a)	CH_4	No		
Fugitive Emissions from Fuels Oil and Natural Gas (1B2b)	**CH_4**	**Yes**	**L,T**	
Fugitive Emissions from Fuels Oil and Natural Gas (1B2c)	CH_4	No		
Fugitive Emissions from Fuels Oil and Natural Gas (1B2d)	**CH_4**	**Yes**	**L, T**	
Fugitive Emissions from Fuels Oil and Natural Gas (1B2a)	N_2O	No		
Fugitive Emissions from Fuels Oil and Natural Gas (1B2b)	N_2O	No		
Fugitive Emissions from Fuels Oil and Natural Gas (1B2c)	N_2O	No		
Fugitive Emissions from Fuels Oil and Natural Gas (1B2d)	N_2O	No		
2. INDUSTRIAL PROCESSES				
Mineral Products Cement production (2A1)	**CO_2**	**Yes**	**L**	
Mineral Products Lime production (2A2)	**CO_2**	**Yes**	**L,T**	
Mineral Products Limestone and dolomit use (2A3)	**CO_2**	**Yes**	**L**	
Mineral Products Asphalt roofing (2A5)	CO_2	No		
Mineral Products Road paving with asphalt (2A6)	CO_2	No		
Mineral Products Other (2A7)	**CO_2**	**Yes**	**T**	
Mineral Products Other (2A7)	CH_4	No		
Mineral Products Other (2A7)	N_2O	No		
Chemical Industry Ammonia production (2B1)	**CO_2**	**Yes**	**L,T**	
Chemical Industry Ammonia production (2B1)	CH_4	No		
Chemical Industry Ammonia production (2B1)	N_2O	No		

Table A1-7. *Key category analysis summary – with LULUCF*

SOURCE CATEGORY ANALYSIS SUMMARY – WITH LULUCF				
Quantitative Method Used: [X] **Tier 1** [ ] **Tier 2**				
A	**B**	**C**	**D**	**E**
IPCC Source Categories	**Direct Greenhouse Gas**	**Key Source Category Flag (Yes or No)**	**If C Yes. Criteria for Identification**	**Comments**
Chemical Industry Nitric acid production (2B2)	CO_2	No		
Chemical Industry Nitric acid production (2B2)	**N_2O**	**Yes**	**T**	
Chemical Industry Other (2B5)	CO_2	No		
Chemical Industry Other (2B5)	CH_4	No		
Chemical Industry Other (2B5)	N_2O	No		
Metal Production Iron and steel production (2C1)	CO_2	No		
Metal Production Iron and steel production (2C1)	CH_4	No		
Metal Production Ferroalloys production (2C2)	CO_2	No		
Metal Production Ferroalloys production (2C2)	CH_4	No		
Metal Production Aluminium production (2C3)	CO_2	No		
Metal Production Aluminium production (2C3)	CH_4	No		
Metal Production Aluminium production (2C4)	PFCs	No		
Other Production (2D)	CO_2	No		
Production of Halocarbons and SF6 (2E)	HFCs	No		
Production of Halocarbons and SF6 (2E)	PFCs	No		
Production of Halocarbons and SF6 (2E)	SF_6	No		
Consumption of Halocarbons and SF6 Refrigeration and air conditioning equipment (2Fa1)	**HFCs**	**Yes**	**L**	
Consumption of Halocarbons and SF6 Refrigeration and air conditioning equipment (2Fa1)	PFCs	No		
Consumption of Halocarbons and SF6 Refrigeration and air conditioning equipment (2Fa1)	SF_6	No		
Consumption of Halocarbons and SF6 Foam blowing (2Fa2)	HFCs	No		
Consumption of Halocarbons and SF6 Foam blowing (2Fa2)	PFCs	No		
Consumption of Halocarbons and SF6 Foam blowing (2Fa2)	SF_6	No		
Consumption of Halocarbons and SF6 Fire extinguishers (2Fa3)	HFCs	No		
Consumption of Halocarbons and SF6 Fire extinguishers (2Fa3)	PFCs	No		
Consumption of Halocarbons and SF6 Fire extinguishers (2Fa3)	SF_6	No		

Table A1-7. *Key category analysis summary – with LULUCF*

SOURCE CATEGORY ANALYSIS SUMMARY – WITH LULUCF				
Quantitative Method Used: ☒ **Tier 1** ☐ **Tier 2**				
A	**B**	**C**	**D**	**E**
IPCC Source Categories	**Direct Greenhouse Gas**	**Key Source Category Flag (Yes or No)**	**If C Yes. Criteria for Identification**	**Comments**
Consumption of Halocarbons and SF6 Aerosols (2Fa4)	HFCs	No		
Consumption of Halocarbons and SF6 Aerosols (2Fa4)	PFCs	No		
Consumption of Halocarbons and SF6 Aerosols (2Fa4)	SF_6	No		
Consumption of Halocarbons and SF6 Electrical equipment (2Fa8)	HFCs	No		
Consumption of Halocarbons and SF6 Electrical equipment (2Fa8)	PFCs	No		
Consumption of Halocarbons and SF6 Electrical equipment (2Fa8)	SF6	No		
Consumption of Halocarbons and SF6 Other (2Fa9)	HFCs	No		
Consumption of Halocarbons and SF6 Other (2Fa9)	PFCs	No		
Consumption of Halocarbons and SF6 Other (2Fa9)	SF_6	No		
Feedstocks (2G1)	**CO_2**	**Yes**	**L, T**	
Nonenergy use (2G2)	CO_2	No		
3. SOLVENT AND OTHER PRODUCT USE				
Paint Application (3a)	CO_2	No		
Degreasing and Dry Cleaning (3b)	CO_2	No		
Other (3d)	**N_2O**	**Yes**	**L, T**	
4. AGRICULTURE				
Enteric Fermentation (4A1)	**CH_4**	**Yes**	**L,T**	ca
Enteric Fermentation (4A2)	CH_4	No		bu
Enteric Fermentation (4A3)	**CH_4**	**Yes**	**L**	sh
Enteric Fermentation (4A4)	CH_4	No		ot
Manure Management (4B1)	CH_4	No		ca
Manure Management (4B2)	CH_4	No		bu
Manure Management (4B3)	CH_4	No		sh
Manure Management (4B4)	CH_4	No		ot
Manure Management (4B8)	**CH_4**	**Yes**	**L,T**	**sw**

Table A1-7. *Key category analysis summary – with LULUCF*

SOURCE CATEGORY ANALYSIS SUMMARY – WITH LULUCF				
Quantitative Method Used: [X] **Tier 1** [ ] **Tier 2**				
A	**B**	**C**	**D**	**E**
IPCC Source Categories	**Direct Greenhouse Gas**	**Key Source Category Flag (Yes or No)**	**If C Yes. Criteria for Identification**	**Comments**
Manure Management (4B12)	N_2O	No		liq
Manure Management (4B13)	**N_2O**	**Yes**		**so**
Rice Cultivation (4C)	CH_4	No		
Agricultural Soils Direct soil emissions (4D1)	CH_4	No		
Agricultural Soils Direct soil emissions (4D1)	**N_2O**	**Yes**	**L,T**	
Agricultural Soils Pasture, range and paddock manure (4D2)	N_2O	No		
Agricultural Soils Indirect emissions (4D3)	CH_4	No		
Agricultural Soils Indirect emissions (4D3)	**N_2O**	**Yes**	**L,T**	
Field Burning of Agricultural Residues (4F)	CH_4	No		
Field Burning of Agricultural Residues (4F)	N_2O	No		
5. LAND USE, LAND-USE CHANGE AND FORESTRY				
Forest Land, remaining (5A1)	**CO_2**	**Yes**	**L,T**	
Forest Land, remaining (5A1)	CH_4	No		
Forest Land, remaining (5A1)	N_2O	No		
Forest Land, land converted to (5A2)	CO_2	No		
Forest Land, land converted to (5A2)	CH_4	No		
Forest Land, land converted to (5A2)	N_2O	No		
Cropland, remaining (5B1)	**CO_2**	**Yes**	**L**	
Cropland, remaining (5B1)	CH_4	No		
Cropland, remaining (5B1)	N_2O	No		
Cropland, land converted to (5B2)	**CO_2**	**Yes**	**L, T**	
Cropland, land converted to (5B2)	CH_4	No		
Cropland, land converted to (5B2)	N_2O	No		
Grassland, remaining (5C1)	**CO_2**	**Yes**	**L, T**	
Grassland, remaining (5C1)	CH_4	No		

Table A1-7. *Key category analysis summary – with LULUCF*

SOURCE CATEGORY ANALYSIS SUMMARY – WITH LULUCF				
Quantitative Method Used: [X] **Tier 1** [ ] **Tier 2**				
A	**B**	**C**	**D**	**E**
IPCC Source Categories	**Direct Greenhouse Gas**	**Key Source Category Flag (Yes or No)**	**If C Yes. Criteria for Identification**	**Comments**
Grassland, remaining (5C1)	N_2O	No		
Grassland, land converted to (5C2)	**CO_2**	**Yes**	**L, T**	
Grassland, converted to (5C2)	CH_4	No		
Grassland, land converted to (5C2)	N_2O	No		
Settlements, remaining (5E1)	CO_2	No		
Settlements, remaining (5E1)	CH_4	No		
Settlements, remaining (5E1)	N_2O	No		
Settlements, land converted to (5E2)	CO_2	No		
Settlements, land converted to (5E2)	CH_4	No		
6. WASTE				
Solid Waste Disposal on Land (6A)	**CH_4**	**Yes**	**L,T**	
Waste (6B1)	CH_4	No		
Waste (6B2)	**CH_4**	**Yes**	**L**	
Waste (6B1)	N_2O	No		
Waste (6B2)	N_2O	No		
Waste Incineration (6C)	CO_2	No		
Waste Incineration (6C)	CH_4	No		
Waste Incineration (6C)	N_2O	No		

Abbrevations in this table:

li – liquid fuels
so – solid fuels/category
ga – gaseous fuels
ot – other fuels/category
bi – biomass
lr – liquid fuels, residual fuel oil
ld – liquid fuel, diesel oil
lg – liquid fuel, gasoline
lu – liquid fuel, lubricants
sc – solid fuel, coal
lk – liquid fuel, kerosene
ll – liquid fuel, LPG
gn – gaseous fuel, natural gas

ca – cattle
bu –buffalo
sh – sheep
sw – swine

A1.5. References

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Annex 2 Detailed discussion of methodology and data for estimating CO_2 emissions from fossil fuel combustion

A2.1. Fuel Consumption Data

The GHG emission calculations of fossil fuel combustion are based on the Hungarian energy balance prepared by Energia Központ Kht. The summary table of the energy balance for 2009 can be seen in *Table A2-6***.**
Energia Központ Kht. collects fuel consumption data from users and prepares the energy balance and other statistics. Independent experts check the raw data of the energy balance and they compare them with energy consumption data from other sources (e.g. data from MVM Rt.). After the quality check the Energy Statistics is published.
The energy statistics has a chapter about the energy carries balances by branches. Nowadays, division into branches (*Table A2-1*) follows mainly the structure of ISIC 3.1. Detailed EU-conform statistics from industrial and energy industrial activities help to compile the *sectoral approach*.

Branches	ISIC 3.1 code	IPCC code as treated in the Hungarian inventory
Manufacture of food, beverage and tobacco products	DA	1.AA.2.E
Man. of textiles and textile products	DB	1.AA.2.F
Man. of leather and leather products	DC	1.AA.2.F
Man. of wood and wood products	DD	1.AA.2.F
Man. of pulp, paper and paper products	DE	1.AA.2.D
Man of coke, refined petroleum products	DF	1.AA.1.B and 1.AA.1.C
Man. of chemicals, chemical products	DG	1.AA.2.C
Man. of rubber and plastic products	DH	1.AA.2.C
Man. of other non-metallic mineral products	DI	1.AA.2.F**
Man. of basic metals and fabricated metal products	DJ	1.AA.2.A
Man. of machinery and equipment n.e.c.	DK	1.AA.2.F
Man. of electrtical and optical equipment	DL	1.AA.2.F
Manufacture of transport equipment	DM	1.AA.2.F
Manufacturing n.e.c.	DN	1.AA.2.F
Total of manufacture industries	*D*	
Mining and Quarrying	C	1.AA.2.F
Electr., Gas, Steam and Hot Water Supply	E40	1.AA.1.A and 1.AA.4.A
Water Management	E41	1.AA.4.A
Total Industry		
Construction	F	1.AA.2.F
Agriculture	A 01	1.AA.4.C
Forestry and Logging	A 02	1.AA.4.C
Agriculture, Forestry and Logging	*A*	
Transport and Storage	I 60–63	1.AA.4.A
Communications	I 64	1.AA.4.A
Transport, Storage and Communication	*I*	
Residential	P	1.AA.4.B
Public Services and Commerce *	G, H, J–O	1.AA.4.A
Total Inland Consumption		

Table A2-1. *Categories in the energy carries balances of the Energy Statistics*
* included Real estate activities, Public administration and Sewage and refuse disposal sections
** for the first time it is reported in the appropriate CRF category

A2.2. EU ETS Data

In January 2005 the European Union Greenhouse Gas Emission Trading Scheme (EU ETS) commenced operation as the largest multi-country, multi-sector Greenhouse Gas emission trading scheme world-wide. The scheme is based on Directive 2003/87/EC, which entered into force on 25 October 2003 in the EU. This law came into force in the Hungarian legal system in 2005 (2005/XV.).

A2.3. Comparison of energy statistics and EU ETS Data

For the sake of transparency and comparability with EU ETS data the ERT recomended to report NCVs of both data sources. All of the coal based power plants are under the regulation of emission trading, so the comparision can be performed. The results are in the table (*Table A2-2*) below.

Consumption of public electricity and heat plants	EU ETS		Energy statistics	
	kt	TJ	kt	TJ
Other bituminous or sub-bituminous coal (NCV: 17-33 MJ/kg)	204.2	5,171	207	5,176
Lignite (NCV: 10-17 MJ/kg)	1,012.2	12,424	1,058	12,595
Lignite (NCV: 3.5-10 MJ/kg)	7,917.6	53,402	7,918	53,410
Total Coal	***9,134***	***70,986***	***9,794***	***71,181***

Table A2-2. *Power plants' coal consumption from EU ETS and energy statistics*

A2.4. Source of the Country Specific Emission Factors

Fuel type	Emission factor (CO_2 t/TJ)	Oxidation factor
Other Bituminous Coal	92.44	0.95
Lignite (lignite)	112.17	0.974
Lignite (brown coal)	99.28	0.98
Coke Oven Gas	46.13	0.995
Gas/Diesel Oil	79.08	0.99
Residual Fuel Oil	76.85	0.99
Other Oil	80.31	1.00
Waste	65.38	1.00

Table A2-3. *Country specific emission factors in the Energy Industries subsector*

The Act 2005/XV. appoints which installation have to join in the EU ETS. It is required, for establishments that emit more than 500 kt CO_2/year, to measure the calorific value, the carbon content and oxidation factor of used coal in accredited laboratory. Last years installations with lower emission rate also began to report measured carbon content of used fuels to EU ETS.
The official laboratory reports of the measured values in the EU ETS are available for internal use for the GHG team, we use this data to define new emission factors that suit better to the Hungarian conditions. Instead of IPCC default emission factors we can calculate the national emissions using more appropriate values. These country specific emission factors are listed in *Table A2-3*.

A2.4.1. Solid fuels

The Hungarian coal terminology differs slightly from that of IPCC. The partitioning is created according to the age of coal; *Table A2-4*. shows the classification according to the Hungarian and IPCC (2006) categories.

Hungarian Terminology	Net Calorific Values	IPCC Category (Gross calorific value)
Hard Coal	17-33 MJ/kg	Other Bituminous Coal (>23.865 MJ/kg)
Hard Coal	17-33 MJ/kg	Sub-Bituminous Coal (17.435 MJ/kg -23.865 MJ/kg)
Brown Coal	10-17 MJ/kg	Lignite (<17.435 MJ/kg)
Lignite (young brown coal)	3.5-10 MJ/kg	Lignite (<17.435 MJ/kg)

Table A2-4. *Comparison of Hungarian and IPCC terminology for coal (Sources: Bihari, 1998; IPCC, 2006)*

In the CRF the lignite category is a mix of brown coal and lignite with very low NCV, so the reported emission factor vary for two different reasons in the time-series:

- share of the two coal types
- changes in carbon content.

Fott (1999) published his research about the emission factors for the European coal (especially for Czech coal). It was found that carbon emission factor of coals and lignite are dependent especially on the net calorific value. For brown coal-lignite with the lowest net calorific values (lower than 12 MJ/kg) the default (IPCC, 1997) value 27.6 t C/TJ (101.2 t CO_2/TJ) seems to be too small.

Measured carbon contents and oxidation factors of coals in 2009 are listed in *Table A2-5*. NCVs of coals in the energy statistics were different than the measured values from EU ETS (see *Table A2-2*), therefore emission factors were corrected to achieve consistency in the energy balance and verified emissions, too. Measured oxidation factors was also applied in the calculation to have consistent datasets.

Fuel type	Measured carbon content (C t/TJ)	Oxidation factor
Hard Coal (17-33 MJ/kg)	25.2	0.9496
Brown coal (10-17 MJ/kg)	27.1	0.9800
Lignite (3.5-10 MJ/kg)	30.6	0.9737
Coke oven gas	12.58	default

Table A2-5. *Measured carbon contents and oxidation factors from EU ETS for solid fuels and derived gas*

A2.4.2. Liquid fuels

Measured EFs from EU ETS were also taken into account in the calculation of CO_2 emissions of main electricity plants – as recomended by the ERT. For the harmonization of the ETS and inventory the applied emission factors were determinated from the weighted average of EFs from reports of power plants. As measurment is not required for all power plants and for all fuel types, the resulted EFs (in *Table A2-3*) is a mixture of IPCC default and real measured values.

A2.5. Reference approach

Energy Centre publishes Energy Statistics Yearbooks, which contain the used activity data (production, imports, exports, stock change, non-energy use) for each fuel type in summary tables (see *Table A2-6*), individual tables for time-series of each fuel type from 1985 until the previous year of publishing date (whole time-series can be seen only in the electronic format). Conversion factor was taken as 1.0 in all categories, because Energy Statistics Yearbook represents fuels in energy units (TJ), as well. Default emission factors were used in most cases. There are only two exceptions, namely, the category of lignite and other bituminous coal (see explanation above in *section A2.3*). Fraction of carbon stored is the default IPCC value for bitumen and coal oils and tars. It was decided to remove all carbon content of feedstocks and non-energy use for all other fuels. With this method the *reference* and *sectoral approach* are comparable (see in chapter 3.2.1 of the NIR). Fraction of carbon oxidized is in accordance with Revised Guidelines (IPCC, 1997).

A2.6. References

Bihari, P., 1998: Energetics II. – university manuscript (In Hungarian: Energetika II., kézirat), *Budapesti Műszaki Egyetem*, Budapest.

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Table A2-6 Hungarian energy balance for 2009

Hungarian Energy Balance for 2009

Unit: TJ	Primary Energy Production	Import	From Stock Decreasing	From Transformation	Waste Energy	Total Source and Distribution	Domestic Consumption	Direct Consumption	Direct: Non-energy use	For Transformation	Exports	For Stock Increasing	Statistical Differences	Transformation Losses
PRIMARY ENERGY	**458,478**	**605,729**	**5,396**			1,069,603	**844,129**	**318,273**	**13,534**	525,867	**5,362**	**40,697**		
Coal	65,104	46,589	860			112,553	112,139	7,927		104,212	414	0		
Crude OIL	33,055	226,747	4,536			264,338	264,338	1,383		262,955	0	0		
Natural Gas	95,765	331,059	0			426,823	383,171	265,937	13,534	117,234	2,955	40,697		
NGL	9,259					9,259	*see LPG*							
Hydro Power	821					821	*see Electricity*							
Nuclear Power	166,143					166,143	*see Electricity*							
Prod.of Wind Power Plant	1,182					1,182	*see Electricity*							
Firewood	28,204	783				28,987	26,994	8,514		18,480	1,993			
Other Primary Energy	8,736					8,736	8,736	0		8,736				
Estimated Renewables Energy [1]	44,891					44,891	44,891	34,511		10,380				
Municipal Solid Waste	3,309	551				3,860	3,860	0		3,860				
SECONDARY ENERGY	**0**	**127,191**	**6,652**	433,056	6,587	573,486	**538,540**	**513,995**	**60,904**	24,545	**100,908**	**843**		
Briquette		358	0	187		545	466	452		14		79		
Ahydrated Lignite						0	0	0						
Coke		170	1,315	22,149		23,634	19,068	18,981		87	4,566	0		
Other Product from Coal Proc.				1,705		1,705	1,705	1,705	1,705					
LPG		7,732	488	3,340		11,559	15,614	15,614	6,930		5,204	0		
Gasoline		30,188	2,026	87,834		120,048	104,988	104,988	41,594		15,059	0		
Petroleum		0	0	10,134		10,134	9,672	9,672	0		336	126		
Gas / Diesel Oil		53,024	1,082	113,820		167,926	127,234	121,719	1,752	5,515	40,692	0		
Heavy Fuel Oil		948	1,626	14,703		17,277	16,353	10,279		6,074	923	0		
Bitumen		2,895	0	20,497		23,392	8,862	8,841	8,838	21	13,892	638		
Other Refinery Product		12,029	59	19,594		31,682	14,266	6,684	85	7,583	17,417	0		
Coke Oven Gas				5,837		5,837	5,837	5,070		767				
Blast Furnace Gas					6,587	6,587	6,587	2,640		3,947				
Heat energy				53,164		53,164	53,164	53,164						
Electricity				71,724		71,724	146,117	146,117						
Import Electricity		19,647				19,647	*see Electricity*							
Petroleum Coke		0	56	8,368		8,424	5,606	5,068		538	2,818	0		
TOTAL ENERGY	**458,478**	**732,920**	**12,048**	433,056	6,587	1,643,089	**1,382,669**	**832,267**	**74,438**	550,402	**106,270**	**41,540**	112,610	117,346
Unaccumulated Consumption	458,478	732,920	12,048			1,203,446	1,055,636							

1) incl. the estemated firewood, biomass and waste, geothermal, biogas, wind, solar, etc. energy

Source: Energia Központ Kht., 2010: Energy Statistics Yearbook, 2009 (In Hungarian: Energia Statisztika Évkönyv, 2009), Table 19/a and 19/b

Annex 3 Other detailed methodological descriptions for individual source or sink categories

A3.1. Energy

CH_4 and N_2O emission calculation for road transport

The used method for emission estimation of road transport consist of the following steps:

1. Quantification of stock of each road vehicle type is based on data obtained from HCSO and KTI. The categories are the following:
   - Gasoline:
     a. Passenger car, uncontrolled
     b. Passenger car, early oxidation catalyst
     c. Passenger car, 2-stroke engine
     d. Passenger car, three-way catalyst
     e. Motorcycles
     f. Light duty vehicle
     g. Light duty vehicle, catalyst
     h. Heavy duty vehicle
     i. Heavy duty vehicle, catalyst
     j. Bus
   - LPG
   - Natural Gas
   - Other fuel
   - Diesel
     a. Passenger car
     b. Light duty vehicle
     c. Heavy duty vehicle
     d. Bus
2. Identification of fuel consumption for 100 km of each category is based on dafault values from Revised Guidelines, 2006 IPCC Guidelines and official fuel consumption database.
3. Correction of fuel consumption of each vehicle type with real sharing in traffic is based on KTI reports.
4. Calculation of proportion in total annual fuel consumption for each category and fuel type. Total annual fuel consumption for each fuel type is given in the Energy Statistics Yearbook.
5. Calculation of total annual fuel consumption for each category and fuel type.
6. Calculation of total annual emission from category specific emission factors (see *Table 3.9 in Chapter 3.4*) and total annual fuel consumption for each category and fuel type .
7. Addition of emissions in each fuel type.

A3.2. Industry

Specific emission factors for aluminium production

According to the recommendations of the Revised Guidelines (IPCC, 1997) and the Good Practice Guidance (IPCC, 2000), the value of the specific emission factor was determined using a Tabereaux approximation as follows:

$$EF = Slope \cdot AEF \cdot AED \quad . \qquad \textit{Equation A3-1.}$$

where *EF* means the emission factor (kg/t). Slope is derived from

$$Slope = \begin{cases} 1.698 \cdot \frac{p}{CE} & \text{for } CF_4 \\ 0.1698 \cdot \frac{p}{CE} & \text{for } C_2F_6 \end{cases} \qquad \textit{Equation A3-2.}$$

According to the Revised Guidelines for the given technology *p=0.04* and *CE=0.91* were used as constants. In *Equation A3-1*. *AEF* means the effect number, *AED* is the effect time. On the basis of factory data, the value of AEF is between 0.8 to 2.8 pcs/pot-day and the value of AED is 4 minutes. Information on the pot types, effect number and effect time were supplied by the factories. Currently, only vertical-stud pots are used in Hungary, although horizontal-stud pots were also present in the beginning of the period. *Table A3-1* shows the calculated specific emission factors.

Emission factor (kg/t)	BY	1990	1991	1992	1993	1994	1995	1996	1997	1998
CF_4	0.4907	0.4856	0.5010	0.6775	0.7045	0.7225	0.7046	0.6419	0.6359	0.6837
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
CF_4	0.8390	0.7732	0.7703	0.7242	0.7849	0.8813	0.0000	0.0000	0.0000	0.0000

Table A3-1. *Specific emission factors for aluminium production*

A3.3. Solvent and Other Product Use

Carbon and NMVOC ratio of solvents

The Revised Guidelines (IPCC, 1997) provide little help for calculation of specific emission factor for solvents. Compositions and solvent contents were previously coordinated with the Paint Industry. Due to these discussions, paints, lacquers, kits etc. were classified into several groups according to the mean solvent content and NMVOC emissions were taken to be equal to the amount of solvent.

On the basis of solvent composition, the mean carbon content of each category was determined using the method described in the following exemplary calculation.

“Usual” solvent composition of solvent based paints: 48 % white spirit, 40% xylene, 12 % esters. In accordance with the empirical formula of chemical substance, the carbon content can be calculated. E.g., the empirical formula of xylene is C_8H_{10}. From this, the carbon content is 90.5 % w/w. Similarly, carbon contents were obtained by calculating the other components and their carbon contents, and weighting it according to the solvent composition. These are shown in the second column of *Table A3-2*.

	Carbon content (%)	Solvent content (%)
Solvent based paints	81.4	50
Water based paints	57.0	6-8
Other paints, lacquers etc.	80.0	25
Glues etc.	57.0	8
Solvents	81.6	100

Table A3-2. *Solvent and carbon contents of paints, lacquers, glues etc.*

By this, the amount of carbon (C) from NMVOC (for each type of paint) and, upon multiplying it by 44/12, the amount of CO_2 may be calculated. In *Table A3-3* the mean carbon and NMVOC ratios are shown for the last 9 years. The decreasing numbers indicate the increasing proportion of water based paints. However, the proportion of water based paints has continued to increase in 2005, this C/NMVOC ratio has increased due to decreasing amount of the group of glues and thinners, which has changed the previous ratio of solvents' composition.

	2001	2002	2003	2004	2005	2006	2007	2008	2009
C/NMVOC	0.7690	0.7607	0.7540	0.7426	0.7650	0.7682	0.7705	0.7607	0.7567

Table A3-3. *Mean carbon and NMVOC ratio of solvents for the last 9 years*

A3.4. LULUCF

Implementation of the consistent area representation in Hungary

Land-use change database covering the total land area of the country according to six broad IPCC land-use categories, which contains information about former land-use categories of the converted areas as well, was not available for Hungary. Therefore the main steps of the implementation of consistent area representation were the classification of total area of the country into six IPCC land-use categories using the available land-use and land-cover statistics for the whole time series, and then the specification of land-use changes using the available land-cover change datasets. This type of land-use representation resulted in a mix of the Approach 1 and Approach 2 area representation methods.
To achieve a complete territorial coverage of the country, three different dataset were used. The next table summarises the coverage of the IPCC land-use categories relating to Hungary, along with data sources.

Table A3-4 *Coverage and data sources of IPCC land-use categories in Hungary*

IPCC land-use categories	Category used in the database	Data sources
Forest Land	Land under Forest Management	NFI (CAO Forestry Directorate)
Cropland	Arable land	HCSO's land-use statistics
	Kitchen garden	
	Orchard	
	Vineyard	
	Set-aside Cropland	Expert judgement
Grassland	Grassland (medows and pastures)	HCSO's land-use statistics
	Set-aside Grassland	Expert judgement
Settlements	Artificial surfaces	CLC2006, CLC-change$_{1985\text{-}1990}$, CLC-change$_{1990\text{-}2000}$, CLC-change$_{2000\text{-}2006}$.
Wetlands	Wetlands and Water bodies	CLC2006, CLC-change$_{1985\text{-}1990}$, CLC-change$_{1990\text{-}2000}$, CLC-change$_{2000\text{-}2006}$.
Other Land	Sparsely vegetated areas	HCL85, CLC90, CLC2000, CLC2006

Databases listed above are delineated in the NIR Chapter 7.1.2.

The NFI and the HCSO's land-use statistics provide data annually for the whole GHG inventory time series, although the HCSO's land-use statistics had to be adjusted due to the methodological changes of data collection and other data collection problems (for more details see the next chapter of the Annexes). The land-cover inventories were available for four year of the time series; data for other years were interpolated and extrapolated.
The area of abandoned agricultural areas was estimated by comparing the annual net change of the Cropland and Grassland areas calculated from the HCSO's land-use statistics and the gross change indicated by the land-cover change databases.
The combination of these three types of statistics resulted in a complete spatial coverage of the country for the whole inventory period with net area data. For specification of inter-category changes supplementary data were used.
Assumptions made and steps of harmonization of net land-use data with the land-use change datasets were as follows:

- The CLC-change$_{1990\text{-}2000}$ and CLC-change$_{2000\text{-}2006}$ were supplemented with a third database referring to 1985-1990. The supplementary database was implemented by processing satellite images (HCL-change$_{1985\text{-}1990}$). The other existing two databases were standardized according to the new one. The standardization and the processing of satellite images were developed according to the requirements of the LULUCF GHG inventory, and it was implemented by the Institute of Geodesy, Cartography and Remote Sensing (FÖMI, 2009b).
- The standardized land-cover categories implemented by the FÖMI were classified into the IPCC categories. The classification is shown in Table A3.-5.

Table A3-5 *Classification of the land-cover categories into IPCC land-use categories*

Standardized land-cover categories	IPCC category
100	Forest land
210, 220	Cropland
230	Grassland
310	Settlements
400, 500	Wetlands
330	Other land

- The land-cover data were taken into account according to their acquisition date. The acquisition dates of 1985, 1990, 2000 and 2006 databases are 1986, 1992, 2000 and 2006, respectively. (FÖMI, 2004; FÖMI, 2009a; FÖMI, 2009b)
- In the next step the net changes calculated from the three land-use change matrices derived from land-cover databases for the periods 1986-1992, 1992-2000 and 2000-2006 were compared with the net changes in the HCSO's land-use statistics calculated for the similar periods.
- It was assumed that the land-use change in a certain IPCC land-use change category is equal to the land-cover change in the corresponding land-cover change category (See Table A3-5). It was also presumed that the difference between the net change in the HCSO's land-use statistics and the land-cover change dataset in a certain land-use category arises due to the conversions on set-aside agricultural areas. Therefore the above-mentioned differences were eliminated with the estimated conversions on the set-aside grassland and cropland areas.
- From the three land-use change matrices, the land conversions were calculated for each year, so that the sum of the land-use changes in each land-use categories in the time period should be equal to the land-cover changes indicated by the land-cover database in that category for the given period.
- The procedures delineated above resulted in the gross annual changes of the needed land-use change categories. These matrices provided the activity data for the calculation of carbon stock changes in living non-woody biomass in Grassland and Cropland category.
- In the next step the 20 year transition period were taken into account. It was assumed that all land-use transitions originated from the remaining categories, and the conversion categories are not converted again during the 20 year transition period.

The annual land-use changes are presented for the period 1985-2009 in Tabe A3-6.

Table A3-6 *Annual land-use changes 1985-2009 (ha)*

ha	Forest Land	Cropland	SA-CL	Grassland	SA-GL	Wetlands	Settlements	Other Land
Forest Land		95	0	21	0	0	210	0
Cropland	2,778		0	5,338	0	0	838	0
SA-CL	8,388	7,640		0	0	129	0	0
Grassland	1,864	4,910	0		16,811	0	391	0
SA-GL	1,515	0	0	0		169	0	0
Wetlands	16	0	0	0	0		14	0
Settlements	118	9	0	117	0	23		0
Other Land	0	0	0	0	0	0	0	
1985	1,755,640	5,293,300	183,964	1,246,400	40,127	254,593	526,798	2,444
Forest Land		95	0	21	0	0	210	0
Cropland	2,453		0	5,338	0	0	838	0
SA-CL	5,548	215		0	0	129	0	0
Grassland	1,864	4,910	0		11,011	0	391	0
SA-GL	558	0	0	0		169	0	0
Wetlands	11	0	0	0	0		14	0
Settlements	84	9	0	117	0	23		0
Other Land	0	0	0	0	0	0	0	
1986	1,765,833	5,289,900	178,071	1,233,700	50,411	254,889	528,018	2,444
Forest Land		95	0	21	0	0	210	0
Cropland	2,778		4,753	0	0	0	838	0
SA-CL	5,730	0		0	0	129	0	0
Grassland	1,864	7,366	0		1,918	0	391	0
SA-GL	711	0	0	0		169	0	0
Wetlands	12	0	0	0	0		14	0
Settlements	90	9	0	117	0	23		0
Other Land	0	0	0	0	0	0	0	
1987	1,776,691	5,289,000	176,966	1,222,300	51,449	255,185	529,232	2,444
Forest Land		95	0	21	0	0	210	0
Cropland	2,778		5,453	0	0	0	838	0
SA-CL	5,774	0		0	0	129	0	0
Grassland	1,864	7,366	0		2,918	0	391	0
SA-GL	724	0	0	0		169	0	0
Wetlands	12	0	0	0	0		14	0
Settlements	90	9	0	117	0	23		0
Other Land	0	0	0	0	0	0	0	
1988	1,787,607	5,287,400	176,516	1,209,900	53,473	255,480	530,446	2,444
Forest Land		95	0	21	0	0	210	0
Cropland	2,778		4,653	0	0	0	838	0
SA-CL	7,989	0		0	0	129	0	0
Grassland	1,864	7,366	0		3,118	0	391	0
SA-GL	1,395	0	0	0		169	0	0
Wetlands	15	0	0	0	0		14	0
Settlements	114	9	0	117	0	23		0
Other Land	0	0	0	0	0	0	0	
1989	1,801,435	5,286,600	173,051	1,197,300	55,028	255,772	531,636	2,444

***Table A3-7** (continued) Annual land-use changes 1985-2009 (ha)*

1989	1,801,435	5,286,600	173,051	1,197,300	55,028	255,772	531,636	2,444
Forest Land		180	0	40	0	0	393	0
Cropland	2,778		2,938	0	0	0	838	0
SA-CL	7,172	0		0	0	129	0	0
Grassland	1,864	7,366	0		2,237	0	391	0
SA-GL	1,147	0	0	0		169	0	0
Wetlands	14	0	0	0	0		14	0
Settlements	105	9	0	117	0	23		0
Other Land	0	0	0	0	0	0	0	
1990	1,813,902	5,287,600	168,688	1,185,600	55,949	256,066	533,017	2,444
Forest Land		60	0	13	0	0	167	0
Cropland	2,778		29,627	16,013	0	0	838	0
SA-CL	6,154	0		0	0	129	0	0
Grassland	1,864	0	0		27,329	0	391	0
SA-GL	839	0	0	0		169	0	0
Wetlands	12	0	0	0	0		14	0
Settlements	94	9	0	117	0	23		0
Other Land	0	0	0	0	0	0	0	
1991	1,825,404	5,238,413	192,032	1,172,160	82,269	256,360	534,184	2,444
Forest Land		44	0	9	0	0	72	0
Cropland	2,778		29,611	16,013	0	0	838	0
SA-CL	7,158	0		0	0	129	0	0
Grassland	1,864	0	0		27,325	0	391	0
SA-GL	1,143	0	0	0		169	0	0
Wetlands	14	0	0	0	0		14	0
Settlements	105	9	0	117	0	23		0
Other Land	0	0	0	0	0	0	0	
1992	1,838,339	5,189,225	214,357	1,158,720	108,282	256,654	535,244	2,444
Forest Land		13	0	83	0	0	233	0
Cropland	3,349		46,503	6,707	0	0	938	0
SA-CL	3,356	0		0	0	197	0	0
Grassland	1,291	8,269	0		10,550	0	297	0
SA-GL	70	0	0	0		147	0	1
Wetlands	18	0	0	0	0		8	0
Settlements	244	28	0	178	0	16		0
Other Land	0	0	0	0	0	0	0	
1993	1,846,338	5,140,038	257,307	1,145,280	118,615	256,988	536,255	2,445
Forest Land		28	0	27	0	0	163	0
Cropland	3,349		46,519	6,707	0	0	938	0
SA-CL	1,498	0		0	0	197	0	0
Grassland	984	8,269	0		10,802	0	297	0
SA-GL	0	0	0	0		147	0	1
Wetlands	13	0	0	0	0		8	0
Settlements	176	28	0	178	0	16		0
Other Land	0	0	0	0	0	0	0	
1994	1,852,141	5,090,851	302,129	1,131,840	129,269	257,327	537,263	2,446

Table A3-8** (continued) Annual land-use changes 1985-2009 **(ha)

1994	1,852,141	5,090,851	302,129	1,131,840	129,269	257,327	537,263	2,446
Forest Land		53	0	61	0	0	244	0
Cropland	3,349		46,543	6,707	0	0	938	0
SA-CL	4,410	0		0	0	197	0	0
Grassland	1,291	8,269	0		10,528	0	297	0
SA-GL	284	0	0	0		147	0	1
Wetlands	21	0	0	0	0		8	0
Settlements	282	28	0	178	0	16		0
Other Land	0	0	0	0	0	0	0	
1995	1,861,421	5,041,664	344,065	1,118,400	139,365	257,658	538,247	2,447
Forest Land		79	0	79	0	0	188	0
Cropland	3,349		46,569	6,707	0	0	938	0
SA-CL	5,242	0		0	0	197	0	0
Grassland	1,291	8,269	0		10,546	0	297	0
SA-GL	453	0	0	0		147	0	1
Wetlands	23	0	0	0	0		8	0
Settlements	312	28	0	178	0	16		0
Other Land	0	0	0	0	0	0	0	
1996	1,871,746	4,992,476	385,194	1,104,960	149,311	257,987	539,144	2,447
Forest Land		192	0	90	0	0	240	0
Cropland	3,349		46,682	6,707	0	0	938	0
SA-CL	6,590	0		0	0	197	0	0
Grassland	1,291	8,269	0		10,558	0	297	0
SA-GL	727	0	0	0		147	0	1
Wetlands	27	0	0	0	0		8	0
Settlements	361	28	0	178	0	16		0
Other Land	0	0	0	0	0	0	0	
1997	1,883,569	4,943,289	425,089	1,091,520	158,995	258,312	540,044	2,448
Forest Land		89	0	42	0	0	271	0
Cropland	3,349		46,579	6,707	0	0	938	0
SA-CL	5,342	0		0	0	197	0	0
Grassland	1,291	8,269	0		10,509	0	297	0
SA-GL	473	0	0	0		147	0	1
Wetlands	23	0	0	0	0		8	0
Settlements	316	28	0	178	0	16		0
Other Land	0	0	0	0	0	0	0	
1998	1,893,962	4,894,102	466,129	1,078,080	168,883	258,641	541,021	2,449
Forest Land		27	0	91	0	0	278	0
Cropland	3,349		46,517	6,707	0	0	938	0
SA-CL	7,879	0		0	0	197	0	0
Grassland	1,291	8,269	0		10,558	0	297	0
SA-GL	988	0	0	0		147	0	1
Wetlands	30	0	0	0	0		8	0
Settlements	408	28	0	178	0	16		0
Other Land	0	0	0	0	0	0	0	
1999	1,907,512	4,844,915	504,570	1,064,640	178,305	258,962	541,912	2,450

***Table A3-9** (continued) Annual land-use changes 1985-2009*

1999	1,907,512	4,844,915	504,570	1,064,640	178,305	258,962	541,912	2,450
Forest Land		68	0	56	0	0	595	0
Cropland	3,349		46,558	6,707	0	0	938	0
SA-CL	8,226	0		0	0	197	0	0
Grassland	1,598	8,269	0		10,217	0	297	0
SA-GL	752	0	0	0		147	0	1
Wetlands	31	0	0	0	0		8	0
Settlements	421	28	0	178	0	16		0
Other Land	0	0	0	0	0	0	0	
2000	1,921,170	4,795,727	542,704	1,051,200	187,622	259,283	543,108	2,451
Forest Land		61	0	101	0	0	359	0
Cropland	7,613		0	1,847	0	0	1,965	0
SA-CL	6,017	4,081		0	0	304	0	0
Grassland	2,479	2,985	0		24,925	0	538	0
SA-GL	0	0	0	0		99	0	0
Wetlands	10	0	0	0	0		35	0
Settlements	177	1	0	119	0	30		0
Other Land	0	0	0	0	0	0	0	
2001	1,936,944	4,791,430	532,303	1,022,340	212,449	259,670	545,679	2,451
Forest Land		109	0	89	0	0	439	0
Cropland	8,553		0	1,847	0	0	1,965	0
SA-CL	7,233	7,356		0	0	304	0	0
Grassland	2,871	2,985	0		24,521	0	538	0
SA-GL	0	0	0	0		99	0	0
Wetlands	12	0	0	0	0		35	0
Settlements	205	1	0	119	0	30		0
Other Land	0	0	0	0	0	0	0	
2002	1,955,180	4,789,516	517,411	993,480	236,871	260,056	548,302	2,451
Forest Land		26	0	44	0	0	523	0
Cropland	5,194		0	1,847	0	0	1,965	0
SA-CL	5,668	4,081		0	0	304	0	0
Grassland	1,976	2,985	0		25,372	0	538	0
SA-GL	0	0	0	0		99	0	0
Wetlands	8	0	0	0	0		35	0
Settlements	141	1	0	119	0	30		0
Other Land	0	0	0	0	0	0	0	
2003	1,967,573	4,787,601	507,359	964,620	262,144	260,445	551,073	2,451
Forest Land		74	0	119	0	0	750	0
Cropland	5,638		0	1,847	0	0	1,965	0
SA-CL	6,300	4,476		0	0	304	0	0
Grassland	2,171	2,985	0		25,251	0	538	0
SA-GL	0	0	0	0		99	0	0
Wetlands	9	0	0	0	0		35	0
Settlements	155	1	0	119	0	30		0
Other Land	0	0	0	0	0	0	0	
2004	1,980,902	4,785,687	496,279	935,760	287,296	260,833	554,057	2,451

Table A3-10 *(continued) Annual land-use changes 1985-2009*

2004	1,980,902	4,785,687	496,279	935,760	287,296	260,833	554,057	2,451
Forest Land		71	0	27	0	0	313	0
Cropland	1,192		0	1,847	0	0	1,965	0
SA-CL	1,141	33		0	0	304	0	0
Grassland	424	2,985	0		26,906	0	538	0
SA-GL	0	0	0	0		99	0	0
Wetlands	2	0	0	0	0		35	0
Settlements	30	1	0	119	0	30		0
Other Land	0	0	0	0	0	0	0	
2005	1,983,280	4,783,772	494,802	906,900	314,103	261,229	556,729	2,451
Forest Land		44	0	21	0	0	443	0
Cropland	5,638		0	1,847	0	0	1,965	0
SA-CL	7,495	4,505		0	0	304	0	0
Grassland	2,301	2,985	0		25,024	0	538	0
SA-GL	88	0	0	0		99	0	0
Wetlands	10	0	0	0	0		35	0
Settlements	170	1	0	119	0	30		0
Other Land	0	0	0	0	0	0	0	
2006	1,998,472	4,781,858	482,498	878,040	338,940	261,616	559,391	2,451
Forest Land		16	0	37	0	0	192	0
Cropland	5,638		0	1,847	0	0	1,965	0
SA-CL	11,899	4,533		0	0	304	0	0
Grassland	2,037	2,985	0		25,303	0	538	0
SA-GL	1,153	0	0	0		99	0	0
Wetlands	13	0	0	0	0		35	0
Settlements	227	1	0	119	0	30		0
Other Land	0	0	0	0	0	0	0	
2007	2,019,194	4,779,943	465,762	849,180	362,991	262,001	561,744	2,451
Forest Land		98	0	35	0	0	160	0
Cropland	5,638		0	1,847	0	0	1,965	0
SA-CL	4,340	4,451		0	0	304	0	0
Grassland	1,815	2,985	0		25,524	0	538	0
SA-GL	0	0	0	0		99	0	0
Wetlands	7	0	0	0	0		35	0
Settlements	129	1	0	119	0	30		0
Other Land	0	0	0	0	0	0	0	
2008	2,030,830	4,778,029	456,667	820,320	388,416	262,390	564,163	2,451
Forest Land		56	0	103	0	0	296	0
Cropland	5,638		0	1,847	0	0	1,965	0
SA-CL	1,867	4,493		0	0	304	0	0
Grassland	1,365	2,985	0		26,041	0	538	0
SA-GL	0	0	0	0		99	0	0
Wetlands	6	0	0	0	0		35	0
Settlements	97	1	0	119	0	30		0
Other Land	0	0	0	0	0	0	0	
2009	2,039,347	4,776,114	450,003	791,460	414,359	262,782	566,751	2,451

Adjustment of HCSO's land use data applied for area representation

One of the most important land-use dataset for the implementation of the consistent area representation in Hungary was the HCSO's land-use statistics. This database is collected annually, by questionnaires, but it is adjusted by the HCSO whenever more detailed dataset is available. Sometimes this adjustment of the HCSO causes significant drops in the year of the adjustment in the time series (e.g. reported Grassland area in the HCSO's statistics decreased by 241.6 thousand hectares from 2009 to 2010 in the HCSO's statistics, as a result of the more detailed General Agricultural survey ,conducted in 2010).

After the change of the regime in Hungary at the beginning of the 1990's, the land of the former large collective farms was mainly distributed among individual farmers. This transformation, when changes in ownership took place, was not entirely transparent (Laczka and Soós, 2003) and it made the data collection more difficult. The changes in the ownership resulted in changes of the system and the method of data collection. (Kecskés, 1997)
Sometimes the time series are reconsidered by the HCSO, and the data for the years before the year of the adjustment are fitted backward to the adjusted, but sometimes not. (The HCSO's land-use statistics are published on the website of the office http://portal.ksh.hu/pls/ksh/docs/eng/xstadat/xstadat_annual/tabl4_01_04iea.html where the green colour signs the reconsideration.)

Significant changes in the time series derived from the problem of data collection which could cause emissions/removals from artefacts. In order to avoid these unreal effects, the dataset was further adjusted by the HMS before making GHG inventory. The adjustment was implemented after consultation with the HCSO's expert. The following paragraphs describe the steps and assumptions in developing the activity data from the HCSO's land-use statistics:

- Between 1985 and 1990 the system of landowners and data collection can be considered as to be in steady state, therefore the annual data was accepted without adjustment.
- The most significant changes of the landownership occurred in the period 1990-2000; therefore the annual dataset for the all categories with exception of orchards and vineyards was replaced with the interpolated values between the two general agricultural censuses which were held in 1990 and 2000. For the vineyards and orchard category the results of the more detailed and reliable census on vineyards and orchards were accepted instead of the results of the general agricultural census. Therefore the interpolation was applied for the years between 1990 and 2001.
- For the period 2000-2010, the annual Cropland and Grassland areas were interpolated between the areas reported for the years of Central Agricultural Surveys conducted in 2000 and 2010. Vineyard and Orchard areas were interpolated between the years for which the most detailed survey data are available (2001 and 2010).

Activity data for estimation of carbon stock change in Cropland living biomass

Table A3-11 *Vineyard activity data for calculation of carbon stock change in living biomass on Cropland (ha) (note: * interpolated value)*

Year	Vineyard Total Area	Adjusted Vineyard Area	Vineyard Area of Agricultural Enterprises	Vineyard Area of Private Farms	Adjusted Vineyard Area of Private Farms	Vineyard Removal of Agricultural Enterprises	Vineyard Removal of Private Farms (estimated)	Total Vineyard Removal
1985	153,600	153,600	69,553	84,011	84,011	7,706		7,706
BY	148,633	148,633	64,535	84,088	84,088	6,706		6,706
1986	147,400	147,400	63,501	83,943	83,943	6,267		6,267
1987	144,900	144,900	60,551	84,310	84,310	6,144		6,144
1988	142,200	142,200	55,231	86,937	86,937	3,485		3,485
1989	140,300	140,300	50,771	89,574	89,574	2,101		2,101
1990	138,500	138,500	47,050	91,350	91,350	2,152	3,042	5,194
1991	136,400	134,355	41,800	94,600	90,640	1,873	3,728	5,601
1992	135,000	130,209	43,500	91,500	89,930	1,384	3,705	5,089
1993	131,700	126,064	34,300	97,400	89,220	543	3,681	4,224
1994	131,900	121,918	20,500	111,400	88,510	404	3,657	4,061
1995	131,300	117,773	13,900	117,400	87,800	49	3,634	3,683
1996	130,900	113,627	14,600	116,300	87,090	58	3,610	3,668
1997	130,900	109,482	9,140	121,740	86,380	567	3,586	4,153
1998	129,700	105,336	8,100	121,600	85,670	127	3,563	3,690
1999	127,000	101,191	8,350	118,650	84,960	97	3,539	3,636
2000	105,900	97,045	8,740	97,140	84,250	139	3,516	3,655
2001	92,900	92,900	9,340	83,540	83,540	198	3,492	3,690
2002	92,800	91,778	10,000	82,800	81,958	202	3,851	4,053
2003	93,300	90,656	10,500	82,800	80,376	230	3,799	4,029
2004	94,500	89,533	11,300	83,200	78,793	258	3,746	4,004
2005	86,000	88,411	12,840	73,140	77,211	68	3,693	3,761
2006	86,000	87,289	13,250	72,750	75,629	500	3,641	4,141
2007	86,000	86,167	13,250	72,750	74,047	230	3,588	3,818
2008	82,600	85,044	13,000	69,600	72,464	100	3,535	3,635
2009	82,800	83,922	14,300	68,500	70,882	200	3,483	3,683

Table A3-12 *Orchard Activity data for calculation of carbon stock change in living biomass on Cropland (ha) (note: * interpolated value) 1985-2009*

Year	Orchard Total Area	Adjusted Orchard Area	Orchard Area of Agricultural Enterprises	Orchard Area of Private Farms	Adjusted Orchard Area of Private Farms	Orchard Removal of Agricultural Enterprises	Orchard Removal of Private Farms (estimated)	Total Orchard Removal
1985	103,500	103,500	71,210	32,290	32,290	5,628		5,628
BY	99,667	99,667	65,908	33,759	33,759	3,777		3,777
1986	99,000	99,000	65,013	33,987	33,987	2,998		2,998
1987	96,500	96,500	61,500	35,000	35,000	2,705		2,705
1988	94,900	94,900	59,347	35,553	35,553	2,015		2,015
1989	94,300	94,300	56,178	38,122	38,122	1,208		1,208
1990	95,100	95,100	61,100	34,000	34,000	2,142	1,132	3,274
1991	94,100	95,318	53,100	41,000	37,964	1,955	1,264	3,219
1992	94,500	95,536	52,100	42,400	41,927	973	1,396	2,369
1993	93,000	95,755	43,700	49,300	45,891	596	1,528	2,124
1994	92,700	95,973	37,400	55,300	49,855	469	1,660	2,129
1995	93,900	96,191	26,200	67,700	53,818	680	1,792	2,472
1996	94,300	96,409	27,700	66,600	57,782	526	1,924	2,450
1997	95,600	96,627	20,700	74,900	61,745	198	2,056	2,254
1998	96,300	96,845	19,800	76,600	65,709	538	2,188	2,726
1999	96,400	97,064	22,000	74,400	69,673	523	2,320	2,843
2000	95,400	97,282	21,200	74,200	73,636	350	2,452	2,802
2001	97,500	97,500	19,900	77,600	77,600	518	2,584	3,102
2002	97,400	97,078	21,200	76,200	77,011	803	2,564	3,367
2003	98,300	96,656	23,650	74,650	76,422	492	2,545	3,037
2004	102,600	96,233	24,700	77,900	75,833	181	2,525	2,706
2005	102,800	95,811	27,100	75,700	75,244	778	2,506	3,284
2006	102,800	95,389	26,600	76,200	74,656	100	2,486	2,586
2007	101,900	94,967	26,100	75,800	74,067	200	2,466	2,666
2008	98,500	94,544	23,700	74,700	73,478	300	2,447	2,747
2009	98,700	94,122	23,100	75,600	72,889	500	2,427	2,927

Determination of activity data (A_G, A_L) from HCSO statistics for calculation of carbon stock change in living biomass in Cropland

The method recommended by the GPG for LULUCF (IPCC, 2003) requires agricultural statistics on land areas of growing stock and harvested land in perennial woody crops (orchard and vineyards in Hungary) and land conversion data from and to perennial woody Cropland.

The following statistics concerned are published by the HCSO, annually:

- Vineyard total area and areas by legal forms
- Orchard total area and areas by legal forms
- Vineyard removal in the area of agricultural enterprises
- Orchard removal in the area of agricultural enterprises

It can be seen that the HCSO statistics cannot provide information on land conversion by previous and following land-use. Only the total vineyard and orchard areas and removals are known. In addition to that removal statistics are published for the agricultural enterprises only, and this statistic is not available for the private farms that have increasing importance since 1990. (Areas reported as 'area unidentifiable with holdings' in the HCSO statistics was considered as area of private farms.) Thus an estimation procedure was developed for the estimation of removal of private farms as described below.

The following assumptions were made in the course of the estimation procedure:

1. Until 1989 the data on removal in the areas of agricultural enterprises comprises the removed areas by private farms as well. Before the economic change in 1989-90 the land areas of private farms were negligible, and the few private farms used mostly the land of agricultural enterprises thus the agricultural statistics on enterprises contains the activity of mostly private farms as well.

2. According to the Tier 1 methodology of GPG for LULUCF (IPCC, 2003), a 30 year harvest cycle is assumed for perennial woody crops as orchards and vineyards in temperate climate region on the area of private farms. It means that 3.33% of these cultures are removed and replanted in every year.

3. The change of the extent of orchard and vineyard area on private farms derives partially from legal acts (landowner change) instead of plantation and removal. It is evident from *Figure A3-1*. After the economic change the land area of agricultural enterprises decreased continuously while the area of private farms increased. According to the farm structure survey in 2007 the private farms held possession of 74 percent of the total orchard area and 85 percent of the vineyard area. A significant restructuring (landowner changes) took place in the nineties, thus the growing of land areas of private farms derived from the landowner change instead of plantation and on the contrary, the decrease of land areas of agricultural enterprises is not primarily the result of removals.

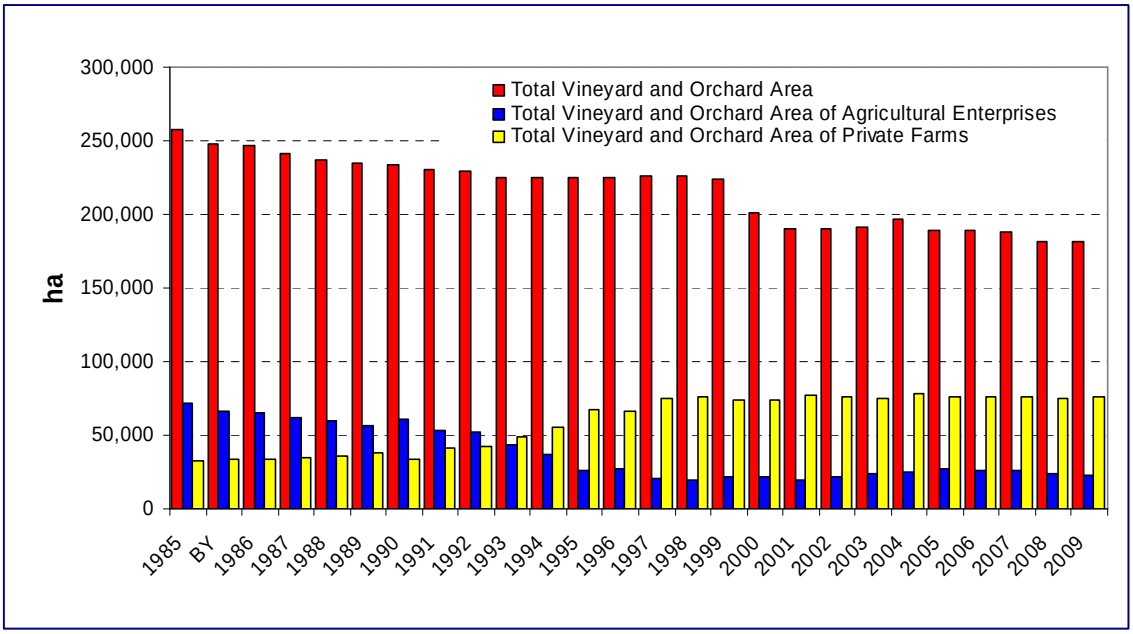

Figure A3-1. *Landowner changes of vineyards and orchards in Hungary 1985-2009*

To separate the area decrease resulting from the landowner change from real removals, the area decrease of private farms was considered as removal in a certain year if the total vineyard/ orchard area decreased as well. If the decrease of the area of private farms exceeds the decrease of the total area, the area decrease is considered as removal in private farms to such an extent that the total area decreased. (Eq. A3-7, A3-8, A3-9)
(To estimate the removal from land area decrease, the total vineyard area was adjusted similarly to the area of private farms, as described below.)

The HCSO collects statistics on vineyard and orchard areas by questionnaire, annually, but in the year of the agricultural censuses, these data derives from a more detailed and more widespread data collection. (There were General Agricultural Censuses in 1990, 2000 and 2010. There was a Census on Orchards and Vineyard in 2001, which is the most detailed data collection on Hungarian vineyard and orchard. There was a Census on the most significant fruit plantation in 2007 as well). As a result of the more widespread data collection in the years of censuses, the differences between the values given for the year of census and the values given for the previous and subsequent years are sometimes significant, especially in the time series of the vineyard area of private farms. Big differences in the time series are the result of the uncertainty of annual data collection among the private farms, as revealed on the course of the General Agricultural Census in 2000. The private farms often reported abandoned vineyards as managed vineyards in the nineties (HCSO, 2001). To insure the consistency of the time series of the area of private farms, this data set was adjusted by linear interpolation between the values given for 1990 and 2001, and between 2001 and 20010, only the most detailed and reliable data collection were taken into account. Results of annual data collection were ignored.

Determination of A_G

Following the assumptions described above, A_G was obtained from the subtracting vineyard and orchard total area (agricultural enterprises and private farms areas summed) the areas of orchard and vineyard plantation in the inventory year (Equation A3-3).

$$A_G=A_{VAE} + A_{VPF}+A_{OAE}+ A_{OPF}$$

Equation A3-3.

Where:
A_G land areas of growing stock
A_{VAE} vineyard areas of agricultural enterprises
A_{VPF} vineyard areas of private farms
A_{OAE} orchard areas of agricultural enterprises
A_{OPF} orchard areas of private farms

These time series are available from the HCSO statistics (*Table A3-11*, *Table A3-12*), although there is a data gap in the year of 2003, which was eliminated by interpolation from the values of the previous and the next years data.

Determination of A_L

The removal of perennial woody crops derives from the vineyard and orchard removal on the area of the agricultural enterprises and on the areas of private farms. The removal arises from rotation (replantation) and the area decrease (abandonment of vineyards and orchards)

$$A_L= A_{VRAE}+ A_{VRPF} +A_{ORAE}+ A_{ORPF}$$

Equation A3-4.

Where:
A_{VRAE} vineyard removal on the areas agricultural enterprises
A_{VRPF} vineyard removal on the areas private farms
A_{ORAE} orchard removal on the areas of agricultural enterprises
A_{ORPF} orchard removal on the areas of private farms

The time series of vineyard and orchard removal on the areas of agricultural enterprises are available from the HCSO statistics (*Table A3-11* and *Table A3-12*), although there is a data gap in the year of 2003, which was eliminated by linear interpolation.

Estimation of removal of private farms as fallows:

$$A_{VRPF} =\{0 \text{ until } 1989 \text{ and } A_{VPF} \cdot 0.333+\min(f(A_{VT}), f(A_{VPF})) \text{ since } 1990\}$$

Equation A3-5.

$$A_{ORPF} =\{0 \text{ until } 1989 \text{ and } A_{VPF} \cdot 0.333+\min(f(A_{OT}), f(A_{OPF})) \text{ since } 1990\}$$

Equation A3-6.

Where:
A_{VT} vineyard total area
A_{OT} orchard total area
f(x) area decrease function

$$f(x)=\{x_{iy-1}- x_{iy} \text{ if } x_{iy-1}- x_{iy} >0 \text{ else } 0\}$$

Equation A3-7.

Where:
x_{iy} area in the inventory year
x_{iy-1} area one year before the inventory year

Activity data and estimated carbon stocks for calculation in carbon stock change in mineral soils of Cropland, Grassland and Other Land

Table A3-13 *Cropland areas by climate zones, soil type and management practices and estimated average carbon stocks*

Land-use	sub-categories				SOC_{ref}	F_{LU}	F_{MG}	F_I	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
	Climate	Soil	Management	Input					Area (ha)											
Cropland	cold dry	HAC	full till	low	50	0.8	1.00	0.92	968.1	966.8	964.0	961.7	960.3	958.5	955.8	953.6	951.8	943.0	941.6	937.4
	cold dry	HAC	full till	medium	50	0.8	1.00	1.00	704.1	703.1	701.1	699.4	698.4	697.1	695.2	693.5	692.2	685.8	684.8	681.8
	cold dry	HAC	full till	high with no manure	50	0.8	1.00	1.07	88.0	87.9	87.6	87.4	87.3	87.1	86.9	86.7	86.5	85.7	85.6	85.2
	cold dry	HAC	reduced till	medium	50	0.8	1.03	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	warm dry	HAC	full till	low	38	0.8	1.00	0.92	1431.4	1429.5	1425.3	1422.0	1420.0	1417.2	1413.3	1410.0	1407.4	1394.4	1392.2	1386.1
	warm dry	HAC	full till	medium	38	0.8	1.00	1.00	1041.0	1039.6	1036.6	1034.2	1032.7	1030.7	1027.9	1025.5	1023.6	1014.1	1012.5	1008.0
	warm dry	HAC	full till	high with no manure	38	0.8	1.00	1.07	130.1	130.0	129.6	129.3	129.1	128.8	128.5	128.2	127.9	126.8	126.6	126.0
	warm dry	HAC	reduced till	medium	38	0.8	1.03	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	cold dry	LAC	full till	low	33	0.8	1.00	0.92	37.2	37.2	37.0	37.0	36.9	36.8	36.7	36.6	36.6	36.2	36.2	36.0
	cold dry	LAC	full till	medium	33	0.8	1.00	1.00	27.1	27.0	26.9	26.9	26.8	26.8	26.7	26.7	26.6	26.4	26.3	26.2
	cold dry	LAC	full till	high with no manure	33	0.8	1.00	1.07	3.4	3.4	3.4	3.4	3.4	3.3	3.3	3.3	3.3	3.3	3.3	3.3
	warm dry	LAC	full till	low	24	0.8	1.00	0.92	29.6	29.6	29.5	29.4	29.4	29.3	29.2	29.2	29.1	28.8	28.8	28.7
	warm dry	LAC	full till	medium	24	0.8	1.00	1.00	21.5	21.5	21.4	21.4	21.4	21.3	21.3	21.2	21.2	21.0	20.9	20.8
	warm dry	LAC	full till	high with no manure	24	0.8	1.00	1.07	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.6	2.6	2.6	2.6
	cold dry	sandy	full till	low	34	0.8	1.00	0.92	74.2	74.1	73.9	73.7	73.6	73.5	73.3	73.1	73.0	72.3	72.2	71.9
	cold dry	sandy	full till	medium	34	0.8	1.00	1.00	54.0	53.9	53.7	53.6	53.5	53.4	53.3	53.2	53.1	52.6	52.5	52.3
	cold dry	sandy	full till	high with no manure	34	0.8	1.00	1.07	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.6	6.6	6.6	6.6	6.5
	warm dry	sandy	full till	low	19	0.8	1.00	0.92	89.2	89.1	88.8	88.6	88.5	88.3	88.1	87.9	87.7	86.9	86.8	86.4
	warm dry	sandy	full till	medium	19	0.8	1.00	1.00	64.9	64.8	64.6	64.5	64.4	64.3	64.1	63.9	63.8	63.2	63.1	62.8
	warm dry	sandy	full till	high with no manure	19	0.8	1.00	1.07	8.1	8.1	8.1	8.1	8.0	8.0	8.0	8.0	8.0	7.9	7.9	7.9
	cold dry	aquic	full till	low	87	0.8	1.00	0.92	188.9	188.7	188.1	187.7	187.4	187.0	186.5	186.1	185.7	184.0	183.7	182.9
	cold dry	aquic	full till	medium	87	0.8	1.00	1.00	137.4	137.2	136.8	136.5	136.3	136.0	135.7	135.3	135.1	133.8	133.6	133.0
	cold dry	aquic	full till	high with no manure	87	0.8	1.00	1.07	17.2	17.2	17.1	17.1	17.0	17.0	17.0	16.9	16.9	16.7	16.7	16.6
	warm dry	aquic	full till	low	88	0.8	1.00	0.92	288.7	288.3	287.5	286.8	286.4	285.8	285.0	284.4	283.8	281.2	280.8	279.5
	warm dry	aquic	full till	medium	88	0.8	1.00	1.00	210.0	209.7	209.1	208.6	208.3	207.9	207.3	206.8	206.4	204.5	204.2	203.3
	warm dry	aquic	full till	high with no manure	88	0.8	1.00	1.07	26.2	26.2	26.1	26.1	26.0	26.0	25.9	25.9	25.8	25.6	25.5	25.4
Total Cropland area (ha)									**5649.7**	**5642.2**	**5625.60**	**5612.7**	**5604.5**	**5593.8**	**5578.3**	**5565.3**	**5554.9**	**5503.5**	**5495.1**	**5470.7**
Carbon stock (Gg C ha^{-1})									**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.2**

Table A3-8 *(continued) Cropland areas by climate zones, soil type and management practices and estimated average carbon stocks*

Land-use	sub-categories				SOC_{ref}	F_{LU}	F_{MG}	F_I	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
	Climate	Soil	Management	Input					Area (ha)											
Cropland	cold dry	HAC	full till	low	50	0.8	1.00	0.92	929.2	923.3	905.7	892.5	880.1	876.8	874.7	873.4	907.0	906.4	906.3	906.0
	cold dry	HAC	full till	medium	50	0.8	1.00	1.00	675.8	671.5	658.7	649.1	640.1	637.7	636.2	635.2	659.6	659.2	659.1	658.9
	cold dry	HAC	full till	high with no manure	50	0.8	1.00	1.07	84.5	83.9	82.3	81.1	80.0	79.7	79.5	79.4	82.5	82.4	82.4	82.4
	cold dry	HAC	reduced till	medium	50	0.8	1.03	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	warm dry	HAC	full till	low	38	0.8	1.00	0.92	1373.9	1365.3	1339.1	1319.6	1301.4	1296.4	1293.4	1291.5	1341.1	1340.2	1340.0	1339.6
	warm dry	HAC	full till	medium	38	0.8	1.00	1.00	999.2	992.9	973.9	959.7	946.4	942.8	940.6	939.3	975.4	974.7	974.6	974.3
	warm dry	HAC	full till	high with no manure	38	0.8	1.00	1.07	124.9	124.1	121.7	120.0	118.3	117.9	117.6	117.4	121.9	121.8	121.8	121.8
	warm dry	HAC	reduced till	medium	38	0.8	1.03	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	cold dry	LAC	full till	low	33	0.8	1.00	0.92	35.7	35.5	34.8	34.3	33.8	33.7	33.6	33.6	34.9	34.8	34.8	34.8
	cold dry	LAC	full till	medium	33	0.8	1.00	1.00	26.0	25.8	25.3	24.9	24.6	24.5	24.4	24.4	25.4	25.3	25.3	25.3
	cold dry	LAC	full till	high with no manure	33	0.8	1.00	1.07	3.2	3.2	3.2	3.1	3.1	3.1	3.1	3.1	3.2	3.2	3.2	3.2
	warm dry	LAC	full till	low	24	0.8	1.00	0.92	28.4	28.2	27.7	27.3	26.9	26.8	26.7	26.7	27.7	27.7	27.7	27.7
	warm dry	LAC	full till	medium	24	0.8	1.00	1.00	20.7	20.5	20.1	19.8	19.6	19.5	19.5	19.4	20.2	20.2	20.2	20.1
	warm dry	LAC	full till	high with no manure	24	0.8	1.00	1.07	2.6	2.6	2.5	2.5	2.4	2.4	2.4	2.4	2.5	2.5	2.5	2.5
	cold dry	sandy	full till	low	34	0.8	1.00	0.92	71.2	70.8	69.4	68.4	67.5	67.2	67.1	67.0	69.5	69.5	69.5	69.5
	cold dry	sandy	full till	medium	34	0.8	1.00	1.00	51.8	51.5	50.5	49.8	49.1	48.9	48.8	48.7	50.6	50.5	50.5	50.5
	cold dry	sandy	full till	high with no manure	34	0.8	1.00	1.07	6.5	6.4	6.3	6.2	6.1	6.1	6.1	6.1	6.3	6.3	6.3	6.3
	warm dry	sandy	full till	low	19	0.8	1.00	0.92	85.6	85.1	83.5	82.3	81.1	80.8	80.6	80.5	83.6	83.5	83.5	83.5
	warm dry	sandy	full till	medium	19	0.8	1.00	1.00	62.3	61.9	60.7	59.8	59.0	58.8	58.6	58.5	60.8	60.8	60.8	60.7
	warm dry	sandy	full till	high with no manure	19	0.8	1.00	1.07	7.8	7.7	7.6	7.5	7.4	7.3	7.3	7.3	7.6	7.6	7.6	7.6
	cold dry	aquic	full till	low	87	0.8	1.00	0.92	181.3	180.2	176.7	174.2	171.7	171.1	170.7	170.4	177.0	176.9	176.8	176.8
	cold dry	aquic	full till	medium	87	0.8	1.00	1.00	131.9	131.0	128.5	126.7	124.9	124.4	124.1	124.0	128.7	128.6	128.6	128.6
	cold dry	aquic	full till	high with no manure	87	0.8	1.00	1.07	16.5	16.4	16.1	15.8	15.6	15.6	15.5	15.5	16.1	16.1	16.1	16.1
	warm dry	aquic	full till	low	88	0.8	1.00	0.92	277.1	275.3	270.1	266.1	262.5	261.5	260.8	260.5	270.5	270.3	270.3	270.2
	warm dry	aquic	full till	medium	88	0.8	1.00	1.00	201.5	200.3	196.4	193.6	190.9	190.2	189.7	189.4	196.7	196.6	196.6	196.5
	warm dry	aquic	full till	high with no manure	88	0.8	1.00	1.07	25.2	25.0	24.6	24.2	23.9	23.8	23.7	23.7	24.6	24.6	24.6	24.6
Total Cropland area (ha)									**5422.7**	**5388.6**	**5285.5**	**5208.4**	**5136.4**	**5116.9**	**5104.8**	**5097.4**	**5293.3**	**5289.9**	**5289.0**	**5287.4**
Carbon stock (Gg C ha^{-1})									38.2	38.2	38.2	38.2	38.2	38.2	38.2	38.2	38.2	38.2	38.2	38.2

Table A3-8 *(continued) Cropland areas by climate zone, soil type and management practices and estimated average carbon stocks*

Land-use	sub-categories				SOC_{ref}	F_{LU}	F_{MG}	F_I	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
	Climate	Soil	Management	Input					Area (ha)									
Cropland	cold dry	HAC	full till	low	50	0.8	1.00	0.92	905.9	906.0	897.6	889.2	880.7	872.3	863.9	855.5	847.0	838.6
	cold dry	HAC	full till	medium	50	0.8	1.00	1.00	658.8	658.9	652.8	646.7	640.5	634.4	628.3	622.2	616.0	596.7
	cold dry	HAC	full till	high with no manure	50	0.8	1.00	1.07	82.4	82.4	81.6	80.8	80.1	79.3	78.5	77.8	77.0	76.2
	cold dry	HAC	reduced till	medium	50	0.8	1.03	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.2
	warm dry	HAC	full till	low	38	0.8	1.00	0.92	1339.4	1339.7	1327.2	1314.7	1302.3	1289.8	1277.4	1264.9	1252.4	1240.0
	warm dry	HAC	full till	medium	38	0.8	1.00	1.00	974.1	974.3	965.2	956.2	947.1	938.0	929.0	919.9	910.9	882.0
	warm dry	HAC	full till	high with no manure	38	0.8	1.00	1.07	121.8	121.8	120.7	119.5	118.4	117.3	116.1	115.0	113.9	112.7
	warm dry	HAC	reduced till	medium	38	0.8	1.03	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.8
	cold dry	LAC	full till	low	33	0.8	1.00	0.92	34.8	34.8	34.5	34.2	33.8	33.5	33.2	32.9	32.6	32.2
	cold dry	LAC	full till	medium	33	0.8	1.00	1.00	25.3	25.3	25.1	24.9	24.6	24.4	24.1	23.9	23.7	23.4
	cold dry	LAC	full till	high with no manure	33	0.8	1.00	1.07	3.2	3.2	3.1	3.1	3.1	3.0	3.0	3.0	3.0	2.9
	warm dry	LAC	full till	low	24	0.8	1.00	0.92	27.7	27.7	27.4	27.2	26.9	26.7	26.4	26.2	25.9	25.6
	warm dry	LAC	full till	medium	24	0.8	1.00	1.00	20.1	20.2	20.0	19.8	19.6	19.4	19.2	19.0	18.8	18.7
	warm dry	LAC	full till	high with no manure	24	0.8	1.00	1.07	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.4	2.3
	cold dry	sandy	full till	low	34	0.8	1.00	0.92	69.4	69.5	68.8	68.2	67.5	66.9	66.2	65.6	64.9	64.3
	cold dry	sandy	full till	medium	34	0.8	1.00	1.00	50.5	50.5	50.0	49.6	49.1	48.6	48.2	47.7	47.2	46.8
	cold dry	sandy	full till	high with no manure	34	0.8	1.00	1.07	6.3	6.3	6.3	6.2	6.1	6.1	6.0	6.0	5.9	5.8
	warm dry	sandy	full till	low	19	0.8	1.00	0.92	83.5	83.5	82.7	82.0	81.2	80.4	79.6	78.8	78.1	77.3
	warm dry	sandy	full till	medium	19	0.8	1.00	1.00	60.7	60.7	60.2	59.6	59.0	58.5	57.9	57.3	56.8	56.2
	warm dry	sandy	full till	high with no manure	19	0.8	1.00	1.07	7.6	7.6	7.5	7.5	7.4	7.3	7.2	7.2	7.1	7.0
	cold dry	aquic	full till	low	87	0.8	1.00	0.92	176.8	176.8	175.2	173.5	171.9	170.2	168.6	166.9	165.3	163.6
	cold dry	aquic	full till	medium	87	0.8	1.00	1.00	128.6	128.6	127.4	126.2	125.0	123.8	122.6	121.4	120.2	119.0
	cold dry	aquic	full till	high with no manure	87	0.8	1.00	1.07	16.1	16.1	15.9	15.8	15.6	15.5	15.3	15.2	15.0	14.9
	warm dry	aquic	full till	low	88	0.8	1.00	0.92	270.1	270.2	267.7	265.2	262.6	260.1	257.6	255.1	252.6	250.1
	warm dry	aquic	full till	medium	88	0.8	1.00	1.00	196.5	196.5	194.7	192.8	191.0	189.2	187.4	185.5	183.7	181.9
	warm dry	aquic	full till	high with no manure	88	0.8	1.00	1.07	24.6	24.6	24.3	24.1	23.9	23.6	23.4	23.2	23.0	22.7
Total Cropland area (ha)									**5286.6**	**5287.6**	**5238.4**	**5189.2**	**5140.0**	**5090.9**	**5041.7**	**4992.5**	**4943.3**	**4894.1**
Carbon stock (Gg C ha^{-1})									**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.2**

Table A3-8 *(continued) Cropland areas by climate zone, soil type and management practices and estimated average carbon stocks*

Land-use	sub-categories				SOC_{ref}	F_{LU}	F_{MG}	F_I	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	Climate	Soil	Manage-ment	Input					Area (ha)										
Cropland	cold dry	HAC	full till	low	50	0.82	1.00	0.92	830.2	821.8	821.0	820.7	820.4	820.0	819.7	819.4	819.0	744.3	693.7
	cold dry	HAC	full till	medium	50	0.82	1.00	1.00	582.8	569.1	560.8	552.9	544.9	536.9	528.9	520.9	513.0	579.5	624.4
	cold dry	HAC	full till	high with no manure	50	0.82	1.00	1.07	75.5	74.7	74.6	74.6	74.6	74.5	74.5	74.5	74.5	74.4	69.4
	cold dry	HAC	reduced till	medium	50	0.82	1.03	1.00	21	28.5	36.3	44.0	51.8	59.5	67.2	75.0	82.7	90.4	98.8
	warm dry	HAC	full till	low	38	0.82	1.00	0.92	1227.5	1215.0	1214.0	1213.5	1213.0	1212.5	1212.0	1211.5	1211.0	1100.5	1027.7
	warm dry	HAC	full till	medium	38	0.82	1.00	1.00	861.3	840.9	828.5	816.5	804.5	792.6	780.6	768.7	756.7	854.9	924.9
	warm dry	HAC	full till	high with no manure	38	0.82	1.00	1.07	111.6	110.5	110.4	110.3	110.3	110.2	110.2	110.1	110.1	110.1	102.8
	warm dry	HAC	reduced till	medium	38	0.82	1.03	1.00	31.4	42.8	54.4	66.0	77.6	89.2	100.8	112.4	124.0	135.6	146.4
	cold dry	LAC	full till	low	33	0.82	1.00	0.92	31.9	31.7	31.7	31.7	31.7	31.7	31.6	31.6	31.6	31.6	28.7
	cold dry	LAC	full till	medium	33	0.82	1.00	1.00	23.2	23.1	23.1	23.0	23.0	23.0	23.0	23.0	23.0	23.0	25.9
	cold dry	LAC	full till	high with no manure	33	0.82	1.00	1.07	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
	warm dry	LAC	full till	low	24	0.82	1.00	0.92	25.4	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	22.9
	warm dry	LAC	full till	medium	24	0.82	1.00	1.00	18.5	18.4	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3	20.6
	warm dry	LAC	full till	high with no manure	24	0.82	1.00	1.07	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
	cold dry	sandy	full till	low	34	0.82	1.00	0.92	63.6	61.9	61.9	61.8	61.8	61.8	61.8	61.7	61.7	61.7	56.1
	cold dry	sandy	full till	medium	34	0.82	1.00	1.00	46.3	45.0	45.0	45.0	45.0	44.9	44.9	44.9	44.9	44.9	50.4
	cold dry	sandy	full till	high with no manure	34	0.82	1.00	1.07	5.8	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6
	warm dry	sandy	full till	low	19	0.82	1.00	0.92	76.5	74.4	74.4	74.3	74.3	74.3	74.3	74.2	74.2	74.2	67.4
	warm dry	sandy	full till	medium	19	0.82	1.00	1.00	55.6	54.1	54.1	54.1	54.1	54.0	54.0	54.0	54.0	53.9	60.7
	warm dry	sandy	full till	high with no manure	19	0.82	1.00	1.07	7.0	6.8	6.8	6.8	6.8	6.8	6.8	6.7	6.7	6.7	6.7
	cold dry	aquic	full till	low	87	0.82	1.00	0.92	162	161.2	161.0	161.0	160.9	160.9	160.8	160.7	160.7	160.6	146.1
	cold dry	aquic	full till	medium	87	0.82	1.00	1.00	117.8	117.2	117.1	117.1	117.0	117.0	116.9	116.9	116.8	116.8	131.5
	cold dry	aquic	full till	high with no manure	87	0.82	1.00	1.07	14.7	14.7	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6
	warm dry	aquic	full till	low	88	0.82	1.00	0.92	247.6	246.3	246.1	246.0	245.9	245.8	245.7	245.6	245.5	245.4	222.8
	warm dry	aquic	full till	medium	88	0.82	1.00	1.00	180	179.1	179.0	178.9	178.8	178.8	178.7	178.6	178.6	178.5	200.6
	warm dry	aquic	full till	high with no manure	88	0.82	1.00	1.07	22.5	22.4	22.4	22.4	22.4	22.3	22.3	22.3	22.3	22.3	22.3
Total Cropland area (ha)									**4844.9**	**4795.7**	**4791.4**	**4789.5**	**4787.6**	**4785.7**	**4783.8**	**4781.9**	**4779.9**	**4778.0**	**4776.1**
Carbon stock (Gg C ha^{-1})									**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.3**	**38.3**	**38.3**	**38.3**	**38.4**	**38.5**

Table A3-14 *Grassland areas by climate zone and soil type and estimated average carbon stocks*

Land-use	sub-categories				SOC_{ref}	F_{LU}	F_{MG}	F_I	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
	Climate	Soil	Management	Input					Area (ha)													
Grassland	cold dry	HAC	non-degraded	-	50	1	1	1	233.6	230.3	230.7	231.1	230.0	229.6	228.7	229.5	229.3	229.2	228.4	230.5	234.1	234.6
	cold dry	HAC	improved	medium	50	1	1.14	1	155.7	153.5	153.8	154.1	153.3	153.0	152.5	153.0	152.9	152.8	152.3	153.7	156.1	156.4
	warm dry	HAC	non-degraded	-	38	1	1	1	345.4	340.5	341.1	341.7	340.0	339.4	338.2	339.4	339.1	338.9	337.7	340.8	346.2	346.8
	warm dry	HAC	improved	medium	38	1	1.14	1	230.3	227.0	227.4	227.8	226.7	226.3	225.5	226.3	226.1	225.9	225.1	227.2	230.8	231.2
	cold dry	LAC	non-degraded	-	33	1	1	1	21.6	21.3	21.3	21.4	21.3	21.2	21.2	21.2	21.2	21.2	21.1	21.3	21.6	21.7
	cold dry	LAC	improved	medium	33	1	1.14	1	9.3	9.1	9.1	9.2	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.3	9.3
	warm dry	LAC	non-degraded	-	24	1	1	1	12.3	12.1	12.1	12.1	12.1	12.1	12.0	12.1	12.1	12.0	12.0	12.1	12.3	12.3
	warm dry	LAC	improved	medium	24	1	1.14	1	12.3	12.1	12.1	12.1	12.1	12.1	12.0	12.1	12.1	12.0	12.0	12.1	12.3	12.3
	cold dry	sandy	non-degraded	-	34	1	1	1	14.6	14.4	14.4	14.4	14.3	14.3	14.3	14.3	14.3	14.3	14.2	14.4	14.6	14.6
	cold dry	sandy	improved	medium	34	1	1.14	1	9.7	9.6	9.6	9.6	9.6	9.5	9.5	9.5	9.5	9.5	9.5	9.6	9.7	9.8
	warm dry	sandy	non-degraded	-	19	1	1	1	20.4	20.1	20.2	20.2	20.1	20.1	20.0	20.1	20.1	20.0	20.0	20.2	20.5	20.5
	warm dry	sandy	improved	medium	19	1	1.14	1	8.8	8.6	8.6	8.7	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.8	8.8
	cold dry	aquic	non-degraded	-	87	1	1	1	77.3	76.2	76.4	76.5	76.1	76.0	75.7	76.0	75.9	75.9	75.6	76.3	77.5	77.7
	cold dry	aquic	improved	medium	87	1	1.14	1	13.6	13.5	13.5	13.5	13.4	13.4	13.4	13.4	13.4	13.4	13.3	13.5	13.7	13.7
	warm dry	aquic	non-degraded	-	88	1	1	1	111.2	109.6	109.9	110.0	109.5	109.3	108.9	109.3	109.2	109.1	108.7	109.7	111.5	111.7
	warm dry	aquic	improved	medium	88	1	1.14	1	27.8	27.4	27.5	27.5	27.4	27.3	27.2	27.3	27.3	27.3	27.2	27.4	27.9	27.9
Total Grassland area (ha)									**1303.9**	**1285.3**	**1287.8**	**1289.9**	**1283.6**	**1281.3**	**1276.8**	**1281.2**	**1280.1**	**1279.2**	**1274.8**	**1286.5**	**1306.8**	**1309.3**
Carbon stock (Gg C ha^{-1})									**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**

Table A3-10 *(continued) Grassland areas by climate zone and soil type and estimated average carbon stocks*

Land-use	sub-categories				SOC_{ref}	F_{LU}	F_{MG}	F_I	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
	Climate	Soil	Management	Input					Area (ha)									
Grassland	cold dry	HAC	non-degraded	-	50	1	1	1	232.3	231.9	230.0	229.9	229.2	226.6	223.3	221.0	219.0	216.8
	cold dry	HAC	improved	medium	50	1	1.14	1	154.9	154.6	153.4	153.3	152.8	151.1	148.9	147.4	146.0	144.5
	warm dry	HAC	non-degraded	-	38	1	1	1	343.5	342.8	340.1	339.9	338.9	335.1	330.2	326.8	296.8	293.8
	warm dry	HAC	improved	medium	38	1	1.14	1	229.0	228.6	226.8	226.6	225.9	223.4	220.1	217.9	242.8	240.4
	cold dry	LAC	non-degraded	-	33	1	1	1	21.5	21.4	21.3	21.3	21.2	21.0	20.6	19.9	18.8	18.6
	cold dry	LAC	improved	medium	33	1	1.14	1	9.2	9.2	9.1	9.1	9.1	9.0	8.8	9.3	10.1	10.0
	warm dry	LAC	non-degraded	-	24	1	1	1	12.2	12.2	12.1	12.1	12.0	11.9	11.7	11.6	11.5	11.4
	warm dry	LAC	improved	medium	24	1	1.14	1	12.2	12.2	12.1	12.1	12.0	11.9	11.7	11.6	11.5	11.4
	cold dry	sandy	non-degraded	-	34	1	1	1	14.5	14.5	14.3	14.3	14.3	14.1	13.9	13.8	12.5	12.4
	cold dry	sandy	improved	medium	34	1	1.14	1	9.7	9.6	9.6	9.6	9.5	9.4	9.3	9.2	10.2	10.1
	warm dry	sandy	improved	medium	19	1	1.14	1	8.7	8.7	8.6	8.6	8.6	8.5	8.4	9.7	9.6	9.5
	cold dry	aquic	non-degraded	-	87	1	1	1	76.9	76.8	76.2	76.1	75.9	75.0	73.9	74.9	72.5	73.4
	cold dry	aquic	improved	medium	87	1	1.14	1	13.6	13.5	13.4	13.4	13.4	13.2	13.0	11.2	12.8	11.0
	warm dry	aquic	non-degraded	-	88	1	1	1	110.6	110.4	109.5	109.5	109.1	107.9	106.3	102.6	117.3	113.5
	warm dry	aquic	improved	medium	88	1	1.14	1	27.7	27.6	27.4	27.4	27.3	27.0	26.6	28.9	13.0	15.5
Total Grassland area (ha)									**1296.6**	**1294.2**	**1284.0**	**1283.3**	**1279.2**	**1264.9**	**1246.4**	**1233.7**	**1222.3**	**1209.9**
Carbon stock (Gg C ha^{-1})									**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**

Table A3-10 *(continued) Grassland areas by climate zone and soil type and estimated average carbon stocks*

Land-use	sub-categories				SOC_{ref}	F_{LU}	F_{MG}	F_I	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
	Climate	Soil	Management	Input					Area (ha)									
Grassland	cold dry	HAC	non-degraded	-	50	1	1	1	214.5	212.4	213.5	224.9	246.2	258.5	270.5	277.1	293.3	296.2
	cold dry	HAC	improved	medium	50	1	1.14	1	143.0	141.6	136.5	121.1	95.8	79.4	63.5	52.8	32.6	25.8
	warm dry	HAC	non-degraded	-	38	1	1	1	296.0	314.1	310.5	317.2	348.9	404.8	424.6	434.2	443.4	447.4
	warm dry	HAC	improved	medium	38	1	1.14	1	232.6	209.4	207.0	194.4	156.8	94.9	69.1	53.7	38.6	28.6
	cold dry	LAC	non-degraded	-	33	1	1	1	18.4	18.2	18.0	18.1	19.2	21.2	22.2	22.5	23.2	23.5
	cold dry	LAC	improved	medium	33	1	1.14	1	9.9	9.8	9.7	9.3	7.9	5.6	4.2	3.7	2.6	2.0
	warm dry	LAC	non-degraded	-	24	1	1	1	11.3	12.5	12.4	12.9	14.2	15.8	17.1	17.3	17.7	18.3
	warm dry	LAC	improved	medium	24	1	1.14	1	11.3	9.8	9.7	8.9	7.3	5.5	4.0	3.5	2.9	2.0
	cold dry	sandy	non-degraded	-	34	1	1	1	12.3	13.2	13.1	13.2	14.3	16.0	16.9	17.5	17.9	18.3
	cold dry	sandy	improved	medium	34	1	1.14	1	10.0	8.8	8.7	8.4	7.0	5.1	4.0	3.1	2.4	1.8
	warm dry	sandy	non-degraded	-	19	1	1	1	17.4	16.7	16.5	16.6	17.4	19.0	20.3	21.3	22.0	22.4
	warm dry	sandy	improved	medium	19	1	1.14	1	9.4	9.8	9.7	9.3	8.2	6.3	4.8	3.5	2.4	1.7
	cold dry	aquic	non-degraded	-	87	1	1	1	72.7	74.5	73.6	75.2	75.9	77.4	76.5	75.6	74.6	74.5
	cold dry	aquic	improved	medium	87	1	1.14	1	10.9	8.3	8.2	5.7	4.0	1.6	1.6	1.5	1.5	0.8
	warm dry	aquic	non-degraded	-	88	1	1	1	112.3	113.8	112.5	111.2	112.3	112.2	112.1	113.1	111.7	111.5
	warm dry	aquic	improved	medium	88	1	1.14	1	15.3	12.6	12.5	12.4	9.8	8.4	7.2	4.7	4.7	3.4
Total Grassland area (ha)									**1197.3**	**1185.6**	**1172.2**	**1158.7**	**1145.3**	**1131.8**	**1118.4**	**1105.0**	**1091.5**	**1078.1**
Carbon stock (Gg C ha^{-1})									**51.7**	**51.6**	**51.5**	**51.4**	**51.0**	**50.6**	**50.3**	**50.2**	**50.0**	**49.8**

Table A3-10 *(continued) Grassland areas by climate zone and soil type and estimated average carbon stocks*

Land-use	sub-categories				SOC_{ref}	F_{LU}	F_{MG}	F_I	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	Climate	Soil	Management	Input					Area (ha)										
Grassland	cold dry	HAC	non-degraded	-	50	1	1.00	1	295.6	293.5	296.1	292.2	285.2	278.0	268.1	260.9	252.3	243.7	234.9
	cold dry	HAC	improved	medium	50	1	1.14	1	22.3	20.4	9.2	4.4	2.9	1.4	2.7	1.3	1.3	1.2	1.2
	warm dry	HAC	non-degraded	-	38	1	1.00	1	451.2	447.9	440.1	432.0	423.8	411.1	398.4	385.7	373.0	360.4	347.9
	warm dry	HAC	improved	medium	38	1	1.14	1	18.8	16.2	11.3	6.6	2.1	2.1	2.0	1.9	1.9	1.8	1.7
	cold dry	LAC	non-degraded	-	33	1	1.00	1	23.4	23.4	23.0	22.8	22.6	21.9	21.2	20.7	20.0	19.3	18.6
	cold dry	LAC	improved	medium	33	1	1.14	1	1.8	1.5	1.2	0.7	0.2	0.2	0.2	0.1	0.1	0.1	0.1
	warm dry	LAC	non-degraded	-	24	1	1.00	1	18.4	18.3	18.1	18.0	18.0	17.4	16.9	16.5	15.9	15.4	14.8
	warm dry	LAC	improved	medium	24	1	1.14	1	1.6	1.5	1.2	0.7	0.2	0.2	0.2	0.1	0.1	0.1	0.1
	cold dry	sandy	non-degraded	-	34	1	1.00	1	18.2	18.0	18.5	18.1	17.6	17.4	16.9	16.3	15.8	15.3	14.7
	cold dry	sandy	improved	medium	34	1	1.14	1	1.6	1.6	0.6	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0
	warm dry	sandy	non-degraded	-	19	1	1.00	1	22.4	22.4	22.2	21.8	21.2	20.9	20.3	19.7	19.0	18.4	17.7
	warm dry	sandy	improved	medium	19	1	1.14	1	1.4	1.2	0.7	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0
	cold dry	aquic	non-degraded	-	87	1	1.00	1	73.5	72.6	70.6	68.6	67.3	65.3	63.3	61.3	59.3	57.2	55.3
	cold dry	aquic	improved	medium	87	1	1.14	1	0.7	0.7	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	warm dry	aquic	non-degraded	-	88	1	1.00	1	110.1	109.8	107.9	104.9	102.9	99.8	96.7	93.6	90.5	87.5	84.3
	warm dry	aquic	improved	medium	88	1	1.14	1	3.4	2.2	1.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Grassland area (ha)									**1064.6**	**1051.2**	**1022.3**	**993.5**	**964.6**	**935.8**	**906.9**	**878.0**	**849.2**	**820.3**	**791.5**
Carbon stock (Gg C ha^{-1})									**49.8**	**49.7**	**49.6**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**

A3.5. References

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Annex 4 Comparison of Sectoral and Reference Approaches

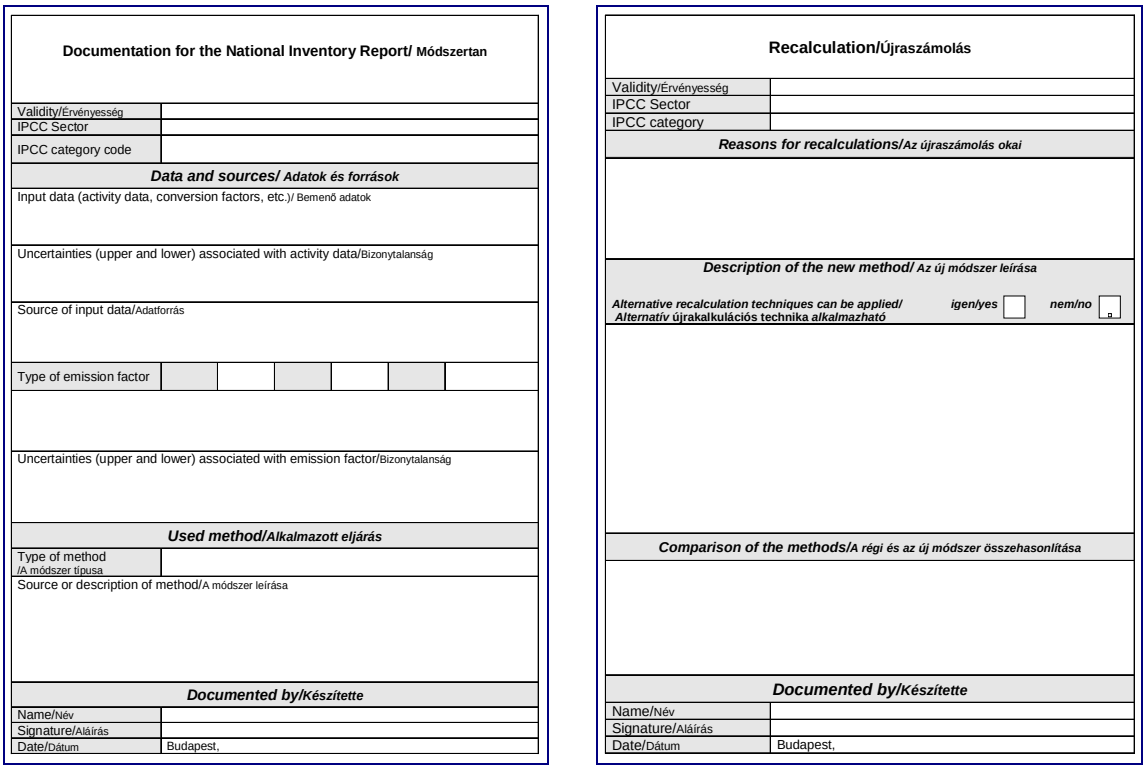
Comparison of sectoral and reference approaches can be found in chapter 3.2.1 of the NIR.

Annex 5 Assessment of completeness

To date, no detailed information is available on assessment of completeness and of potentially excluded sources and sinks of greenhouse gas emissions.

Annex 6 Quality Assurance and Quality Control

QA/QC activities are explained in Chapter 1.6. The following registers are used for documenting data sources, calculation methods, reason and effect of recalculations etc.



Documentation for the National Inventory Report/ Módszertan

Validity/Érvényesség	
IPCC Sector	
IPCC category code	

Data and sources/ Adatok és források

Input data (activity data, conversion factors, etc.)/ Bemenő adatok

Uncertainties (upper and lower) associated with activity data/Bizonytalanság

Source of input data/Adatforrás

Type of emission factor						

Uncertainties (upper and lower) associated with emission factor/Bizonytalanság

Used method/Alkalmazott eljárás

Type of method /A módszer típusa	

Source or description of method/A módszer leírása

Documented by/Készítette

Name/Név	
Signature/Aláírás	
Date/Dátum	Budapest,

Recalculation/Újraszámolás

Validity/Érvényesség	
IPCC Sector	
IPCC category	

Reasons for recalculations/Az újraszámolás okai

Description of the new method/ Az új módszer leírása

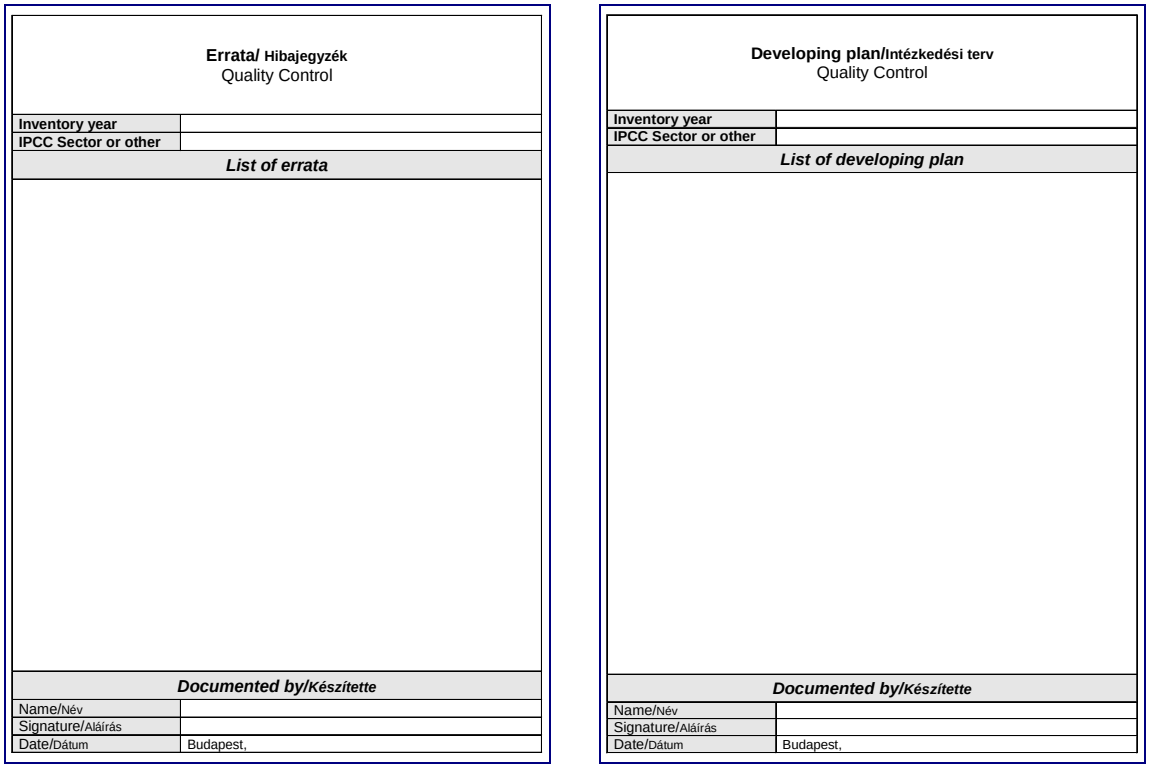
Alternative recalculation techniques can be applied/ Alternatív újrakalkulációs technika alkalmazható ***igen/yes*** ☐ ***nem/no*** ☐

Comparison of the methods/A régi és az új módszer összehasonlítása

Documented by/Készítette

Name/Név	
Signature/Aláírás	
Date/Dátum	Budapest,

Figure A6-1. *Register of used data, data sources and calculation methods and register of recalculations*



Errata/ Hibajegyzék
Quality Control

Inventory year	
IPCC Sector or other	

List of errata

Documented by/Készítette

Name/Név	
Signature/Aláírás	
Date/Dátum	Budapest,

Developing plan/Intézkedési terv
Quality Control

Inventory year	
IPCC Sector or other	

List of developing plan

Documented by/Készítette

Name/Név	
Signature/Aláírás	
Date/Dátum	Budapest,

Figure A6-2. *Register for errata and developing plan*

Quality Control of the National Inventory Report/
Adatminőség ellenőrzés

A./ General QC activity/
Általános QC tevékenység

IPCC code of the audited sector/ Vizsgált szektor és IPCC kódja:	
Inventory year/Vizsgált év:	
Controller/Ellenőrző neve:	

Summary of general findings/
Általános megállapítások összefoglalása

Date/
Dátum: …… …… ……
auditor / ellenőr — sectoral expert / szektorfelelős

Measures suggested by the sectoral expert/
A szektorfelelős javaslata alapján teendő intézkedések

Date/
Dátum: …… …… ……
head of division / osztályvezető — sectoral expert / szektorfelelős

Verification, after the implemented measures still exsisting problems/
Utóellenőrzés, a javító intézkedések után is fennálló problémák

Date/
Dátum: …… …… ……
auditor / ellenőr — sectoral expert / szektorfelelős

Launch of new procedure/Új eljárás indítása:	End of the audit/A vizsgálat lezárása:
Date/ Dátum: …… …… head of division / osztályvezető	Date/ Dátum: …… …… head of division / osztályvezető

Figure A6-3. *Registers for quality control*

B./ CHECKLIST

QC activity/ ***QC tevékenység***	***Procedure of audit/*** ***Az ellenőrzés folyamata***	***Result of audit/*** ***Az ellenőrzés eredménye***
1. Check that assumptions and criteria for the selection of activity data and emission factors are documented. (Ellenőrizze, hogy az alkalmazott tevékenységi adatok, emissziós faktorok, módszertanok dokumentálásra kerültek.)		
2. Confirm that bibliographical data references are properly cited in the internal documentation. (Ellenőrizze, hogy a könyvtári adatokra történő hivatkozásokat pontosan idézték a belső dokumentációban.)		
3. Check that activity data could be reproduced. (Ellenőrizze, hogy a tevékenységi adatok reprodukálhatóak.)		
4. Check that emission factors could be reproduced. (Ellenőrizze, hogy az emissziós faktorok reprodukálhatóak.)		
5. Check that emissions/removals are calculated correctly. (Ellenőrizze, hogy az emissziókat/nyeléseket helyesen számolták ki.)		
6. Compare estimates to previous estimates. (Hasonlítsa össze a becsléseket a korábbi becslésekkel.)		
7. Undertake completeness checks. (Check completeness elvégzése.)		
8. Check methodological and data changes resulting in recalculations. (Ellenőrizze az újraszámításokból előálló módszertani és adatváltozásokat.)		

Annex 7 Uncertainty

Description of methodology used for uncertainty calculation

The first uncertainty calculation for the Hungarian greenhouse gas inventory was reported in 2006 for the year 2004 to fulfill the IPCC requirements for a complete emission inventory. “Uncertainty estimates are an essential element of a complete emissions inventory. Uncertainty information is not intended to dispute the validity of the inventory estimates. but to help prioritise efforts to improve the accuracy of inventories in the future and guide decisions on methodological choice.” (IPCC, 2000)
There are two methods for the uncertainty estimation suggested by the IPCC Good Practice Guidance (2000), a basic method (Tier 1) which is mandatory and an analytic one (Tier 2). The uncertainty analysis for the Hungarian inventory was carried out on the basis of Tier 1 method without the LULUCF sector since uncertainty estimates for activity data are not available for this sector. The disaggregation of the inventory into categories is the same listed in *Table A1-2* and reported in previous submissions, because the uncertainty values were available only for those categories.
The uncertainty calculation was performed using Table 6.1 of the IPCC Good Practice Guidance (2000).
The calculations of the emissions estimates uncertainty are presented, without the sector of LULUCF, in *Table A7-1*.

Table A7-1. *Uncertainty calculation without LULUCF, Tier 1 method*

CRF code	IPCC source category	Direct green-house gas	Base year emission (Gg CO_2-eq.)	Current year (2009) emission (Gg CO_2-eq.)	Activity data uncer-tainty (%)	Emission factor uncer-tainty (%)	Combined uncertainty (%)	Combined uncertainty as % of total emissions in current year
	A	B	C	D	E	F	G	H
			Input data	Input data	Input data	Input data	$\sqrt{E^2+F^2}$	$\frac{G \cdot D}{\sum D}$
1. A.	Stationary Combustion - Gas	CO_2	19 924.15	20 777.81	5	5	7.071	2.204
1. A.	Stationary Combustion - Coal	CO_2	34 208.95	10 432.76	2	5	5.385	0.843
1. A.	Stationary Combustion - Oil	CO_2	16 277.89	3 263.04	2	5	5.385	0.264
1. A.	Non-CO_2 Emission from Stationary Fuel Combustion	N_2O	230.62	129.92	3	50	50.090	0.098
1. A.	Non-CO_2 Emission from Stationary Fuel Combustion	CH_4	884.57	202.65	3	8	8.544	0.026
1. A.	Stationary Combustion - Other Fuel	CO_2	96.89	410.33	5	10	11.180	0.069
1. A. 3.	Mobile Combustion - Other	CO_2	814.20	267.88	5	5	7.071	0.028
1. A. 3.	Mobile Combustion	N_2O	95.63	393.47	5	100	100.125	0.591
1. A. 3.	Mobile Combustion	CH_4	45.19	22.35	5	50	50.249	0.017
1. A. 3. B.	Mobile Combustion - Road	CO_2	6 807.45	11 992.22	5	5	7.071	1.272
1. B. 1.	Fugitive Emissions from Coal Mining and Handling	CH_4	923.01	13.80	3	10	10.440	0.002
1. B. 1.	Fugitive Emissions from Coal Mining and Handling	CO_2	3.60	IE,NA,NO	3	10	10.440	0.000
1. B. 2.	Fugitive Emissions from Oil and Gas Operations (Main Source: Gas Distribution)	CH_4	1 613.47	2 072.85	2	50	50.040	1.556
1. B. 2.	Fugitive Emissions from Oil and Gas Operations	N_2O	0.60	0.23	2	100	100.020	0.000
1. B. 2.	Fugitive Emissions from Oil and Gas Operations	CO_2	195.68	100.10	100	80	128.062	0.192
2.	N_2O Emission from Industry	N_2O	4 541.51	14.81	2	1	2.236	0.000
2.	CH_4 Emission from Industry	CH_4	7.84	25.64	1	20	20.025	0.008

Table A7-1. *Uncertainty calculation without LULUCF, Tier 1 method*

CRF code	IPCC source category	Direct green-house gas	Base year emission (Gg CO_2-eq.)	Current year (2009) emission (Gg CO_2-eq.)	Activity data uncer-tainty (%)	Emission factor uncer-tainty (%)	Combined uncertainty (%)	Combined uncertainty as % of total emissions in current year
	A	B	C	D	E	F	G	H
			Input data	Input data	Input data	Input data	$\sqrt{E^2+F^2}$	$\frac{G \cdot D}{\sum D}$
2. A. 1.	CO_2 Emissions from Cement Production	CO_2	1 778.28	972.71	2	2	2.828	0.041
2. A. 2.	CO_2 Emissions from Lime Production	CO_2	645.03	205.98	5	2	5.385	0.017
2. A. 3.	CO_2 Emission from Limestone and Dolomit Use	CO_2	248.68	271.75	2	1	2.236	0.009
2. A. 7.	CO_2 Emission from Other Mineral Products	CO_2	642.13	164.15	10	30	31.623	0.078
2. B. 1.	CO_2 Emissions from Ammonia Processes	CO_2	1 616.22	432.63	2	2	2.828	0.018
2. B. 2.	CO_2 Emissions from Nitric Acid Production	CO_2	0.082	0.000	3	40	40.112	0.000
2. C.	CO_2 Emissions from Metal Production	CO_2	641.567	180.44	2	5	5.385	0.015
2. C. 3.	PFCs Emissions	PFCs	268.49	1.72	1	2	2.236	0.000
2. F.	Emissions from Substitutes for Ozone Depleting Substances	HFCs	NA,NO	851.29	10	20	22.361	0.286
2. F. 7.	SF_6 Emissions from Electrical Equipment	SF_6	81.02	219.66	80		82.462	0.272
2. G.	Feedstocks and non-energy use of fuels	CO_2	550.97	854.87	5	10	11.180	0.143
3.	N_2O Emission from Solvent and Other Product Use	N_2O	154.17	292.18	2	1	2.236	0.010
3.	CO_2 Emission from Solvent and Other Product Use	CO_2	130.36	47.91	10	20	22.361	0.016
4. A	CH_4 Emissions from Enteric Fermentation in Domestic Livestock	CH_4	3 435.62	1 608.93	0	13.40	13.40	0.324
4. B	CH_4 Emissions from Manure Management	CH_4	2 427.14	960.68	0	24.02	24.02	0.346
4. B.	N_2O Emissions from Manure Management	N_2O	1 899.61	908.04	0	102.10	102.10	1.391
4. C.	CH_4 Emission from Rice Cultivation	CH_4	50.54	11.39	0	198.24	198.24	0.034
4. D. 1.	Direct N_2O Emissions from Agricultural Soils	N_2O	5 490.68	2 873.42	0	381.30	381.30	16.436

Table A7-1. *Uncertainty calculation without LULUCF, Tier 1 method*

CRF code	IPCC source category	Direct green-house gas	Base year emission (Gg CO_2-eq.)	Current year (2009) emission (Gg CO_2-eq.)	Activity data uncer-tainty (%)	Emission factor uncer-tainty (%)	Combined uncertainty (%)	Combined uncertainty as % of total emissions in current year
	A	B	C	D	E	F	G	H
			Input data	Input data	Input data	Input data	$\sqrt{E^2+F^2}$	$\frac{G \cdot D}{\sum D}$
4. D. 2.	Pasture, range and paddock manure	N_2O	336.01	171.64	0	108.89	108.89	0.280
4. D. 3.	Indirect N_2O Emissions from Nitrogen Used in Agriculture	N_2O	3 851.08	1 775.60	0	148.50	148.50	3.955
4. F.	Field Burning of Agricultural Residues	CH_4	45.51	NO	NO	NO	0.000	0.000
4. F.	Field Burning of Agricultural Residues	N_2O	13.34	NO	NO	NO	0.000	0.000
6. A.	CH_4 Emissions from Solid Waste Disposal Sites	CH_4	1 917.30	2 990.24	10	30	31.623	1.419
6. B.	Emissions from Wastewater Handling	CH_4	847.03	475.82	20	30	36.056	0.257
6. B.	Emissions from Wastewater Handling	N_2O	207.70	197.91	10	1000	1000.050	2.969
6. C.	Non-biogenic CO_2 from Waste	CO_2	NA,NO	68.17	10	20	22.361	0.023
6. C.	CH_4 Emissions from Waste Incineration	CH_4	NA	0.86	10	50	50.990	0.001
6. C.	N_2O Emissions from Waste Incineration	N_2O	NA,NO	1.96	5	100	100.125	0.003

Note A

$$\frac{0.01 \cdot D_x + \sum D_i - (0.01 \cdot C_x + \sum C_i)}{(0.01 \cdot C_x + \sum C_i)} \cdot 100 - \frac{\sum D_i - \sum C_i}{\sum C_i} \cdot 100$$

Table A7-2. Uncertainty calculation without LULUCF, Tier 1 method

CRF code	IPCC source category	Direct green-house gas	Type A sensitivity (%)	Type B sensitivity (%)	Uncertainty in trend in emissions introduced by emission factor uncertainty (%)	Uncertainty in trend in emissions introduced by activity data uncertainty (%)	Uncertainty introduced into the trend in total emissions (%)
	A	B	I	J	K	L	M
			Note A	$\frac{D}{\sum C}$	$I \cdot F$	$J \cdot E \cdot \sqrt{2}$	$\sqrt{K^2 + L^2}$
1. A.	Stationary Combustion - Gas	CO_2	0.080	0.182	0.400	1.289	1.350
1. A.	Stationary Combustion - Coal	CO_2	-0.084	0.092	-0.419	0.259	0.493
1. A.	Stationary Combustion - Oil	CO_2	-0.055	0.029	-0.274	0.081	0.286
1. A.	Non-CO_2 Emission from Stationary Fuel Combustion	N_2O	0.000	0.001	-0.002	0.005	0.005
1. A.	Non-CO_2 Emission from Stationary Fuel Combustion	CH_4	-0.003	0.002	-0.022	0.008	0.023
1. A.	Stationary Combustion - Other Fuel	CO_2	0.003	0.004	0.031	0.025	0.040
1. A. 3.	Mobile Combustion - Other	CO_2	-0.002	0.002	-0.009	0.017	0.019
1. A. 3.	Mobile Combustion	N_2O	0.003	0.003	0.296	0.024	0.297
1. A. 3.	Mobile Combustion	CH_4	0.000	0.000	-0.002	0.001	0.002
1. A. 3. B.	Mobile Combustion - Road	CO_2	0.070	0.105	0.351	0.744	0.823
1. B. 1.	Fugitive Emissions from Coal Mining and Handling	CH_4	-0.005	0.000	-0.046	0.001	0.046
1. B. 1.	Fugitive Emissions from Coal Mining and Handling	CO_2	0.000	0.000	0.000	0.000	0.000
1. B. 2.	Fugitive Emissions from Oil and Gas Operations (Main Source: Gas Distribution)	CH_4	0.010	0.018	0.495	0.051	0.498
1. B. 2.	Fugitive Emissions from Oil and Gas Operations	N_2O	0.000	0.000	0.000	0.000	0.000
1. B. 2.	Fugitive Emissions from Oil and Gas Operations	CO_2	0.000	0.001	-0.010	0.124	0.125
2.	N_2O Emission from Industry	N_2O	-0.023	0.000	-0.023	0.000	0.023
2.	CH_4 Emission from Industry	CH_4	0.000	0.000	0.004	0.000	0.004

Table A7-2. Uncertainty calculation without LULUCF, Tier 1 method

CRF code	IPCC source category	Direct green-house gas	Type A sensitivity (%)	Type B sensitivity (%)	Uncertainty in trend in emissions introduced by emission factor uncertainty (%)	Uncertainty in trend in emissions introduced by activity data uncertainty (%)	Uncertainty introduced into the trend in total emissions (%)
	A	B	I	J	K	L	M
			Note A	$\frac{D}{\sum C}$	$I \cdot F$	$J \cdot E \cdot \sqrt{2}$	$\sqrt{K^2 + L^2}$
2. A. 1.	CO_2 Emissions from Cement Production	CO_2	-0.001	0.009	-0.001	0.024	0.024
2. A. 2.	CO_2 Emissions from Lime Production	CO_2	-0.002	0.002	-0.003	0.013	0.013
2. A. 3.	CO_2 Emission from Limestone and Dolomit Use	CO_2	0.001	0.002	0.001	0.007	0.007
2. A. 7.	CO_2 Emission from Other Mineral Products	CO_2	-0.002	0.001	-0.056	0.020	0.059
2. B. 1.	CO_2 Emissions from Ammonia Processes	CO_2	-0.005	0.004	-0.009	0.011	0.014
2. B. 2.	CO_2 Emissions from Nitric Acid Production	CO_2	0.000	0.000	0.000	0.000	0.000
2. C.	CO_2 Emissions from Metal Production	CO_2	-0.002	0.002	-0.009	0.004	0.010
2. C. 3.	PFCs Emissions	PFCs	-0.001	0.000	-0.003	0.000	0.003
2. F.	Emissions from Substitutes for Ozone Depleting Substances	HFCs	0.000	0.007	0.000	0.106	0.106
2. F. 7.	SF_6 Emissions from Electrical Equipment	SF_6	0.002	0.002	0.030	0.218	0.220
2. G.	Feedstocks and non-energy use of fuels	CO_2	0.005	0.008	0.047	0.053	0.071
3.	N_2O Emission from Solvent and Other Product Use	N_2O	0.002	0.003	0.002	0.007	0.007
3.	CO_2 Emission from Solvent and Other Product Use	CO_2	0.000	0.000	-0.005	0.006	0.008
4. A	CH_4 Emissions from Enteric Fermentation in Domestic Livestock	CH_4	-0.004	0.014	-0.047	0.000	0.047
4. B	CH_4 Emissions from Manure Management	CH_4	-0.004	0.008	-0.097	0.000	0.097
4. B.	N_2O Emissions from Manure Management	N_2O	-0.002	0.008	-0.182	0.000	0.182
4. C.	CH_4 Emission from Rice Cultivation	CH_4	0.000	0.000	-0.032	0.000	0.032
4. D. 1.	Direct N_2O Emissions from Agricultural Soils	N_2O	-0.003	0.025	-1.132	0.000	1.132

Table A7-2. Uncertainty calculation without LULUCF, Tier 1 method

CRF code	IPCC source category	Direct green-house gas	Type A sensitivity (%)	Type B sensitivity (%)	Uncertainty in trend in emissions introduced by emission factor uncertainty (%)	Uncertainty in trend in emissions introduced by activity data uncertainty (%)	Uncertainty introduced into the trend in total emissions (%)
	A	B	I	J	K	L	M
			Note A	$\frac{D}{\sum C}$	$I \cdot F$	$J \cdot E \cdot \sqrt{2}$	$\sqrt{K^2 + L^2}$
4. D. 2.	Pasture, range and paddock manure	N_2O	0.000	0.002	-0.024	0.000	0.024
4. D. 3.	Indirect N_2O Emissions from Nitrogen Used in Agriculture	N_2O	-0.004	0.016	-0.622	0.000	0.622
4. F.	Field Burning of Agricultural Residues	CH_4	0.000	0.000	0.000	0.000	0.000
4. F.	Field Burning of Agricultural Residues	N_2O	0.000	0.000	0.000	0.000	0.000
6. A.	CH_4 Emissions from Solid Waste Disposal Sites	CH_4	0.016	0.026	0.492	0.371	0.616
6. B.	Emissions from Wastewater Handling	CH_4	0.000	0.004	-0.005	0.118	0.118
6. B.	Emissions from Wastewater Handling	N_2O	0.001	0.002	0.671	0.025	0.671
6. C.	Non-biogenic CO_2 from Waste	CO_2		0.001	0.000	0.008	0.008
6. C.	CH_4 Emissions from Waste Incineration	CH_4		0.000	0.000	0.000	0.000
6. C.	N_2O Emissions from Waste Incineration	N_2O		0.000	0.000	0.000	0.000

Table A7-3 *Uncertainty calculation for each GHG without LULUCF, Tier 1 method.*

Source category	GHG	Emissions int he current year (2009)	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in current year
		Gg CO_2-eq.	%			
Non-CO_2 Emission from Stationary Fuel Combustion	CH_4	202.65	3.00	8.00	8.54	0.206
Mobile Combustion	CH_4	22.35	5.00	50.00	50.25	0.134
Fugitive Emissions from Coal Mining and Handling	CH_4	13.80	3.00	10.00	10.44	0.017
Fugitive Emissions from Oil and Gas Operations (Main Source: Gas Distribution)	CH_4	2 072.85	2.00	50.00	50.04	12.370
CH_4 Emission from Industry	CH_4	25.64	1.00	20.00	20.02	0.061
CH_4 Emissions from Enteric Fermentation in Domestic Livestock	CH_4	1 608.93	0.00	13.40	13.40	2.572
CH_4 Emissions from Manure Management	CH_4	960.68	0.00	24.02	24.02	2.752
CH_4 Emission from Rice Cultivation	CH_4	11.39	0.00	198.24	198.24	0.269
Field Burning of Agricultural Residues	CH_4	NO	NO	NO	0.00	0.000
CH_4 Emissions from Solid Waste Disposal Sites	CH_4	2 990.24	10.00	30.00	31.62	11.277
Emissions from Wastewater Handling	CH_4	475.82	20.00	30.00	36.06	2.046
CH_4 Emissions from Waste Incineration	CH_4	0.86	10.00	50.00	50.99	0.005
CH_4 uncertainty		**8 385.22**				**17.3**
% of total emission		**12.6**				
Stationary Combustion - Gas	CO_2	20 777.81	5.00	5.00	7.07	2.913
Stationary Combustion - Coal	CO_2	10 432.76	2.00	5.00	5.39	1.114
Stationary Combustion - Oil	CO_2	3 263.04	2.00	5.00	5.39	0.348
Stationary Combustion - Other Fuel	CO_2	410.33	5.00	10.00	11.18	0.091

Table A7-3 *Uncertainty calculation for each GHG without LULUCF, Tier 1 method.*

Source category	GHG	Emissions int he current year (2009)	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in current year
Mobile Combustion - Other	CO_2	267.88	5.00	5.00	7.07	0.038
Mobile Combustion - Road	CO_2	11 992.22	5.00	5.00	7.07	1.681
Fugitive Emissions from Coal Mining and Handling	CO_2	IE,NA,NO	3.00	10.00	10.44	0.000
Fugitive Emissions from Oil and Gas Operations	CO_2	100.10	100.00	80.00	128.06	0.254
CO_2 Emissions from Cement Production	CO_2	972.71	2.00	2.00	2.83	0.055
CO_2 Emissions from Lime Production	CO_2	205.98	5.00	2.00	5.39	0.022
CO_2 Emission from Limestone and Dolomit Use	CO_2	271.75	2.00	1.00	2.24	0.012
CO_2 Emission from Other Mineral Products	CO_2	164.15	10.00	30.00	31.62	0.103
CO_2 Emissions from Ammonia Processes	CO_2	432.63	2.00	2.00	2.83	0.024
CO_2 Emissions from Nitric Acid Production	CO_2	0.00	3.00	40.00	40.11	0.000
CO_2 Emissions from Metal Production	CO_2	180.44	2.00	5.00	5.39	0.019
Feedstocks and non-energy use of fuels	CO_2	854.87	5.00	10.00	11.18	0.189
CO_2 Emission from Solvent and Other Product Use	CO_2	47.91	10.00	20.00	22.36	0.021
Non-biogenic CO_2 from Waste	CO_2	68.17	10.00	20.00	22.36	0.030
CO_2 uncertainty		**50 442.75**				**3.6**
% of total emission		**75.7**				
Non-CO_2 Emission from Stationary Fuel Combustion	N_2O	129.92	3.00	50.00	50.09	0.776
Mobile Combustion	N_2O	393.47	5.00	100.00	100.12	4.698
Fugitive Emissions from Oil and Gas Operations	N_2O	0.23	2.00	100.00	100.02	0.003
N_2O Emission from Industry	N_2O	14.81	2.00	1.00	2.24	0.004

Table A7-3 *Uncertainty calculation for each GHG without LULUCF, Tier 1 method.*

Source category	GHG	Emissions int he current year (2009)	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in current year
N_2O Emission from Solvent and Other Product Use	N_2O	292.18	2.00	1.00	2.24	0.078
N_2O Emissions from Manure Management	N_2O	908.04	0.00	102.10	102.10	11.056
Direct N_2O Emissions from Agricultural Soils	N_2O	2 873.42	0.00	381.30	381.30	130.663
Pasture, range and paddock manure	N_2O	171.64	0.00	108.89	108.89	2.229
Indirect N_2O Emissions from Nitrogen Used in Agriculture	N_2O	1 775.60	0.00	148.50	148.50	31.445
Field Burning of Agricultural Residues	N_2O	NO	NO	NO	0.00	0.000
Emissions from Wastewater Handling	N_2O	197.91	10.00	1 000.00	1 000.05	23.604
N_2O Emissions from Waste Incineration	N_2O	1.96	5.00	100.00	100.12	0.023
N_2O uncertainty		**6 759.18**				**137.0**
% of total emission		**10.1**				
PFCs Emissions	PFCs	1.72	1.00	2.00	2.24	0.004
SF_6 Emissions from Electrical Equipment	SF_6	219.66	80.00	20.00	82.46	16.887
Emissions from Substitutes for Ozone Depleting Substances	HFCs	851.29	10.00	20.00	22.36	2.270
HFCs, PFCs, SF_6 uncertainty		**1 072.68**				**17.0**
% of total emission		**1.6**				

Annex 8 Responses to the review of the 2010 inventory submission

To date, Hungary has not received the review report of the 2010 in-country review.

Annex 9 List of abbrevations and units

Abbrevations

AED	anode effect duration in minutes
AEF	number of anode effects per cellday
BOF	basic oxygen furnace
CAO	Central Agricultural Office
CE	current efficiency
CLC	CORINE Land Cover inventory
CLC-changes	CORINE Land Cover-changes databases
CORINAIR	CORe INventory of AIR emissions
CKD	cement kiln dust
CRF	common reporting format
EAF	electric arc furnace
EF	emission factor
ERT	expert review team
EU	European Union
ETS	Emission Trading Scheme
FÖMI	Institute of Geodesy, Cartography and Remote Sensing (Földmérési és Távérzékelési Intézet)
GDP	gross domestic product
HCSO	Hungarian Central Statistical Office
HKVSZ	Association of Cooling and Air Conditioning Businesses (Hűtő- és Klímatechnikai Vállalkozások Szövetsége)
HLC	Land cover inventory implemented for GHG-inventory purposes
HLC-change	Land cover-change database implemented for GHG-inventory purposes
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
KTI	Institute for Transport Sciences (Közlekedéstudományi Intézet Kht.)
LULUCF	land use, land-use change and forestry
LPG	liquified petroleum gas
MVM Rt.	Hungarian Power Companies Ltd.
NCV	net calorific value
NFI	National Forest Inventory
OHF	open hearth furnace
QA	quality assurance
QC	quality control
UNFCCC	United Nations Framework Convention on Climate Change

Chemical formulas

C	carbon
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
HFCs	hydrofluorocarbons
NMVOC	non-methane volatile organic compound
N_2O	nitrous oxide
NO_x	nitrogen oxide
PFCs	perfluorocarbons
SF_6	sulphur hexafluoride
SO_2	sulphur dioxide

$CaCO_3$	calcium carbonate, limestone
$MgCO_3$	magnesium carbonate
CaO	calcium oxide, quicklime
$Ca(OH)_2$	slack lime
NH_3	ammonia
HNO_3	nitric acid
CF_4	tetrafluoromethane
C_2F_6	hexafluoroethane

Units

PJ	petajoule (10^{15} J)
TJ	terajoule (10^{12} J)
Gg	gigagram (10^9 g)
kt	kilotonnes (1000 t)